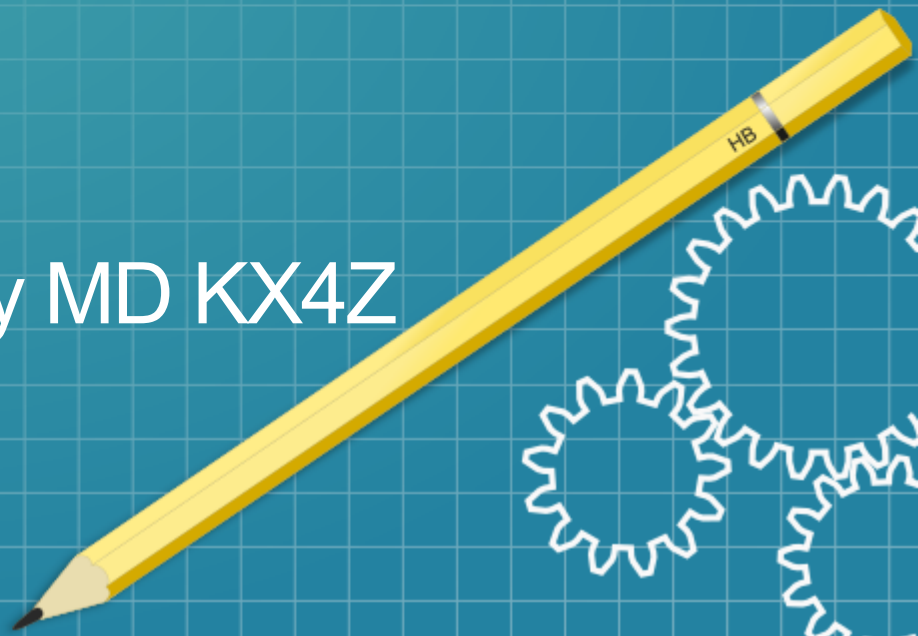
Making Printed Circuit Boards for your group or your project

Gordon L. Gibby MD KX4Z



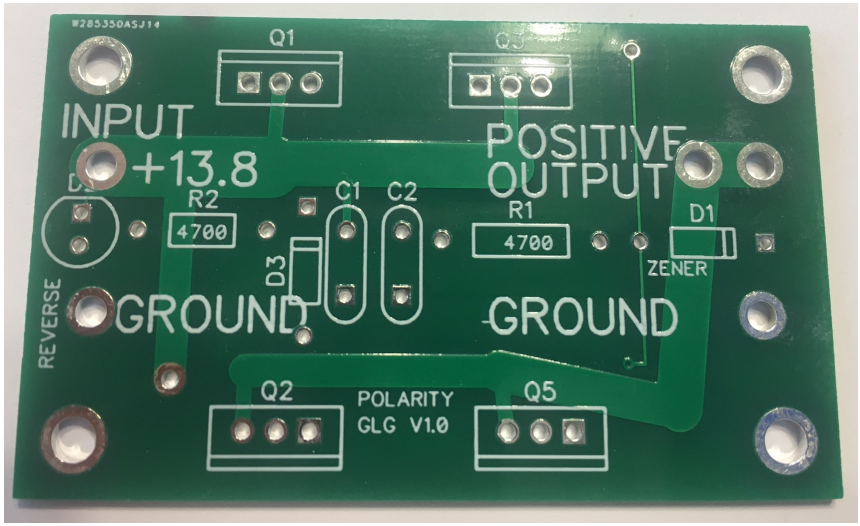
Why printed circuit boards?

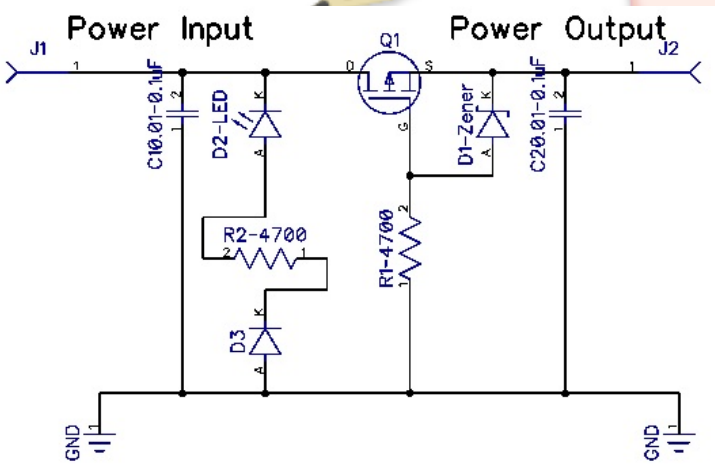
- FAR easier than perfboard point to point construction.
  - 25% of the building time! 75% reduction
- Shielding / Ground Plane Capability
- Microstrip Lines possible.
- High capacity wiring possible.
- Allows builders to focus on Parts
- Supports parts well - Mixed surface mount / thru hole even possible.

WHY BUILD?

- Anti-Alzheimer's Activity!
- TEACH
- Cheaper
- Able to repair your own gear!
- GREAT group building opportunities

WHAT to build?



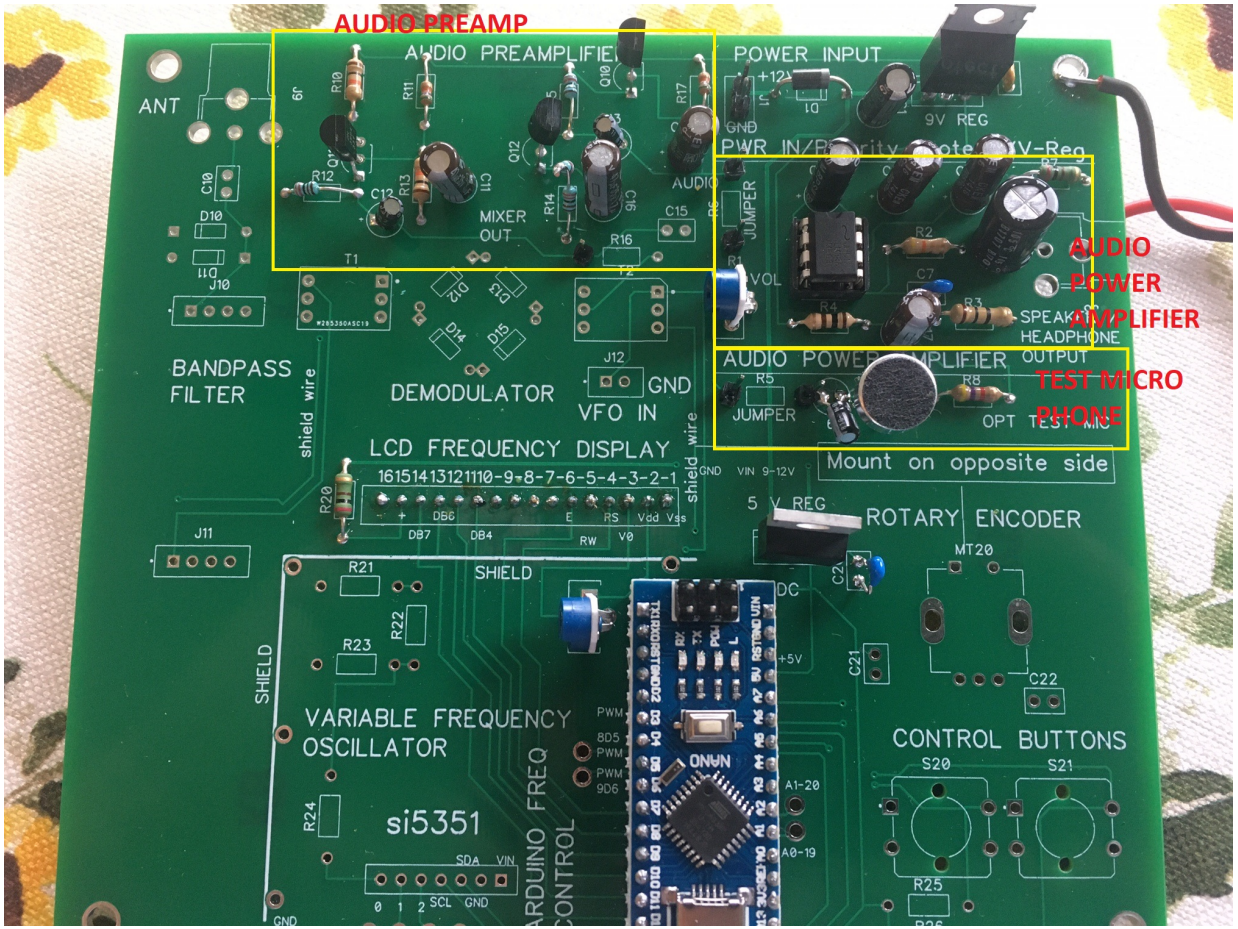


- Much cheaper sound-card systems for older radios
- Directional couplers for many different ranges
- Far cheaper “polarity protectors”
- Common mode current meters
- QRP / tiny receivers / transceivers
- Solid state linear amplifiers
- Bench power supplies
- Lightning arresters / EMP protection
- SCHOOL RECEIVER projects

Enclosures

- Plastic electrical boxes from hardware store
  - CHEAP!
- Metal “tin boxes” see: https://www.specialtybottle.com/
- Simple modeler plywood boxes
- Gift “tin boxes”
- Radio-specific cabinets:
  - Excellway EF01: https://usa.banggood.com/Electronic-Plastic-Shell-Cartridge-Handle-Project-Case-Desk-Instrument-200x175x70mm-p-1035473.html?cur_warehouse=CN
- Surplus radio boxes

School Receiver Project



https://qsl.net/nf4rc/2021/RadioReceiverIntroduction.pdf

https://qsl.net/nf4rc/2021/ZippedGerberRadio.zip

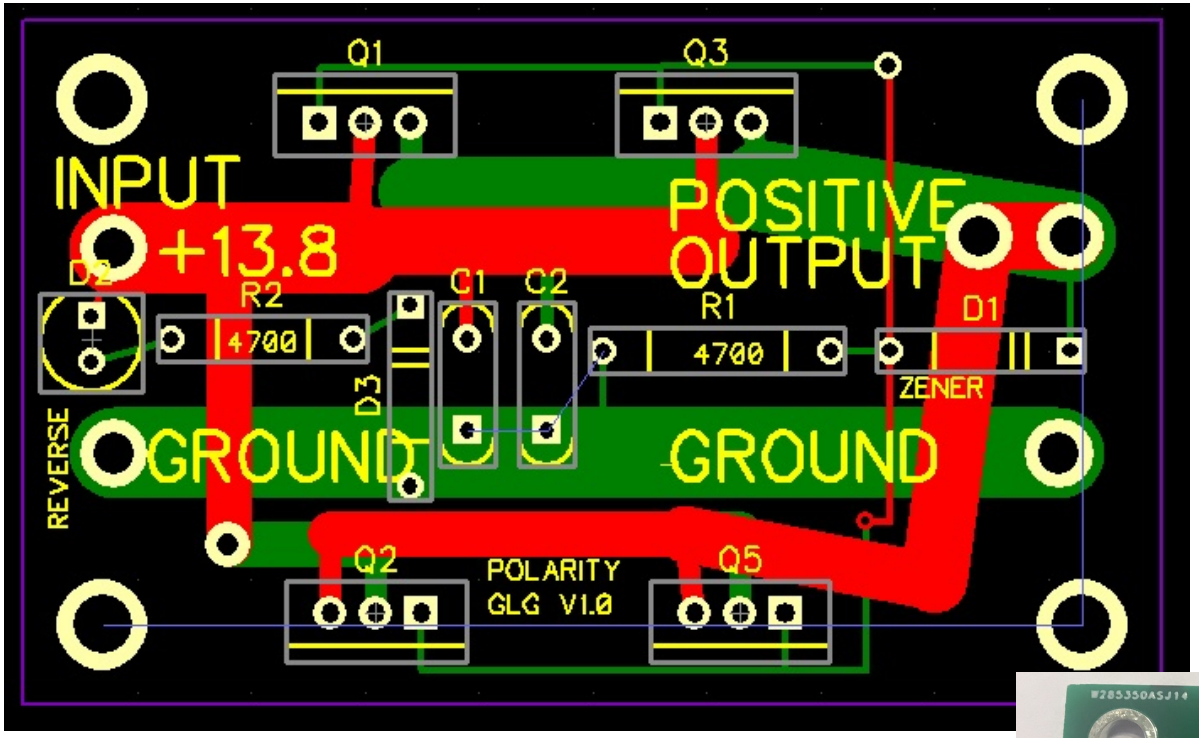
Complete Instructions / kit construction information available on qsl.net/nf4rc:

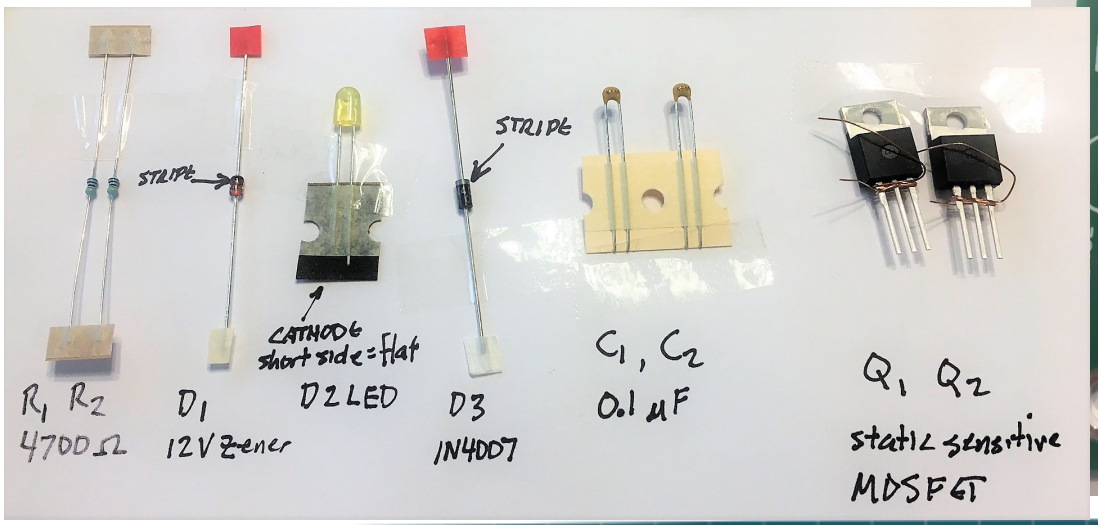
School Radio Kit

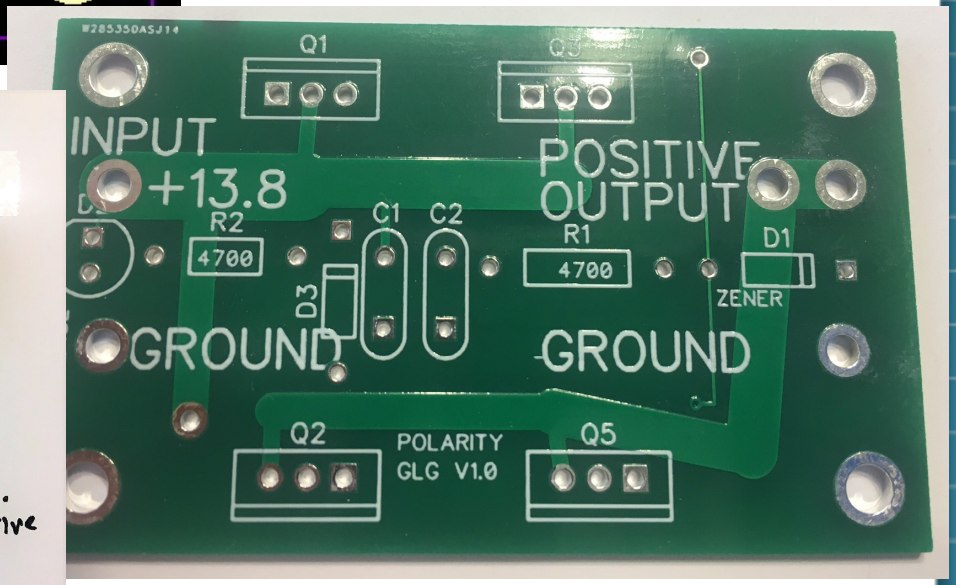
Introduction ToTheRadio
OVERVIEW OF KIT
InstructionsPart1
InstructionsPart2
InstructionsPart3
InstructionsPart4
Product Detector / Balanced Mixer
Bill of Materials
Gerber Files For PCB Fabrication
SimpleArduinoSketch
Example CW Reception
School Receiver Progres Oct '21
Parts Sheet (for kit creators)

Polarity Protector Project

Polarity Protector







Printed Circuit Fabricators

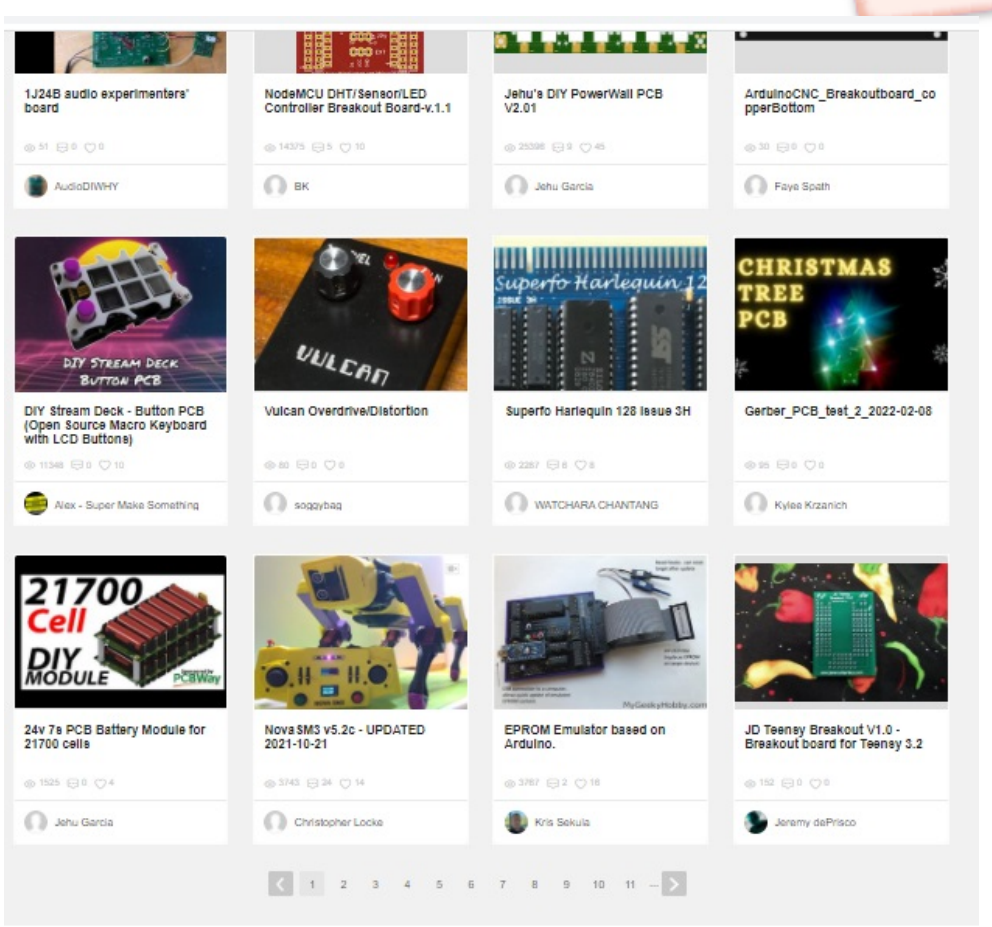
- https://www.expresspcb.com/
  - Free software to create boards
  - 3 printed circuit boards.....$75
  - software simply will NOT produce Gerbers -- you are forced to use their services
- MULTIPLE firms in China that produce boards at FAR cheaper prices and accept “gerber” files
- I’ve used 2 such firms. https://www.pcbway.com/

SHARED PROJECTS

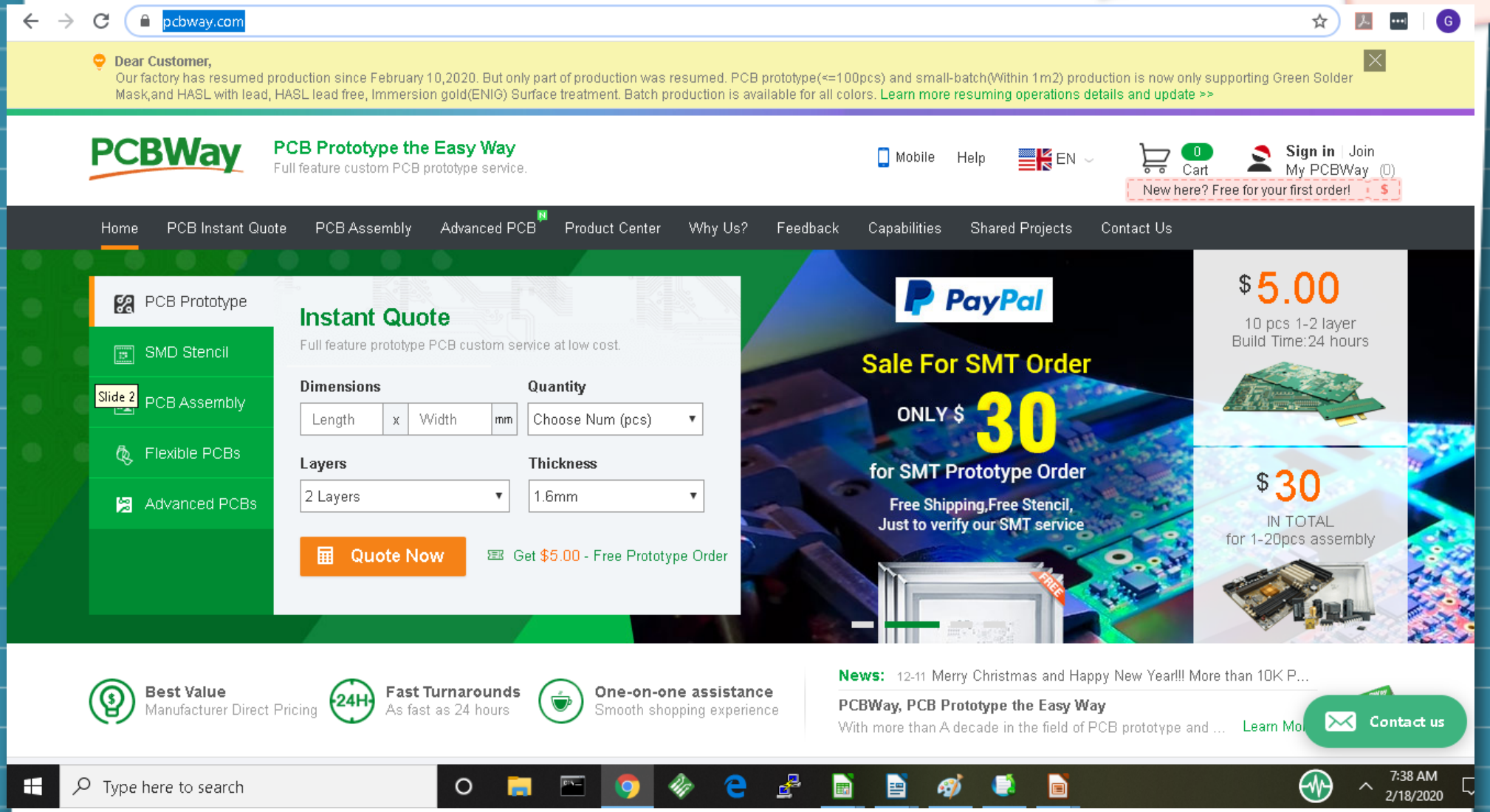
Printed Circuit Board vendors now have hundreds of pre-built pcb gerbers on their sites for you to choose.

Repository of projects.

Gerber viewer also available



pcbway.com


pcbway.com
Dear Customer,
Our factory has resumed production since February 10,2020. But only part of production was resumed. PCB prototype(<=100pcs) and small-batch(Within 1m2) production is now only supporting Green Solder Mask,and HASL with lead, HASL lead free, Immersion gold(ENIG) Surface treatment. Batch production is available for all colors. Learn more resuming operations details and update >>
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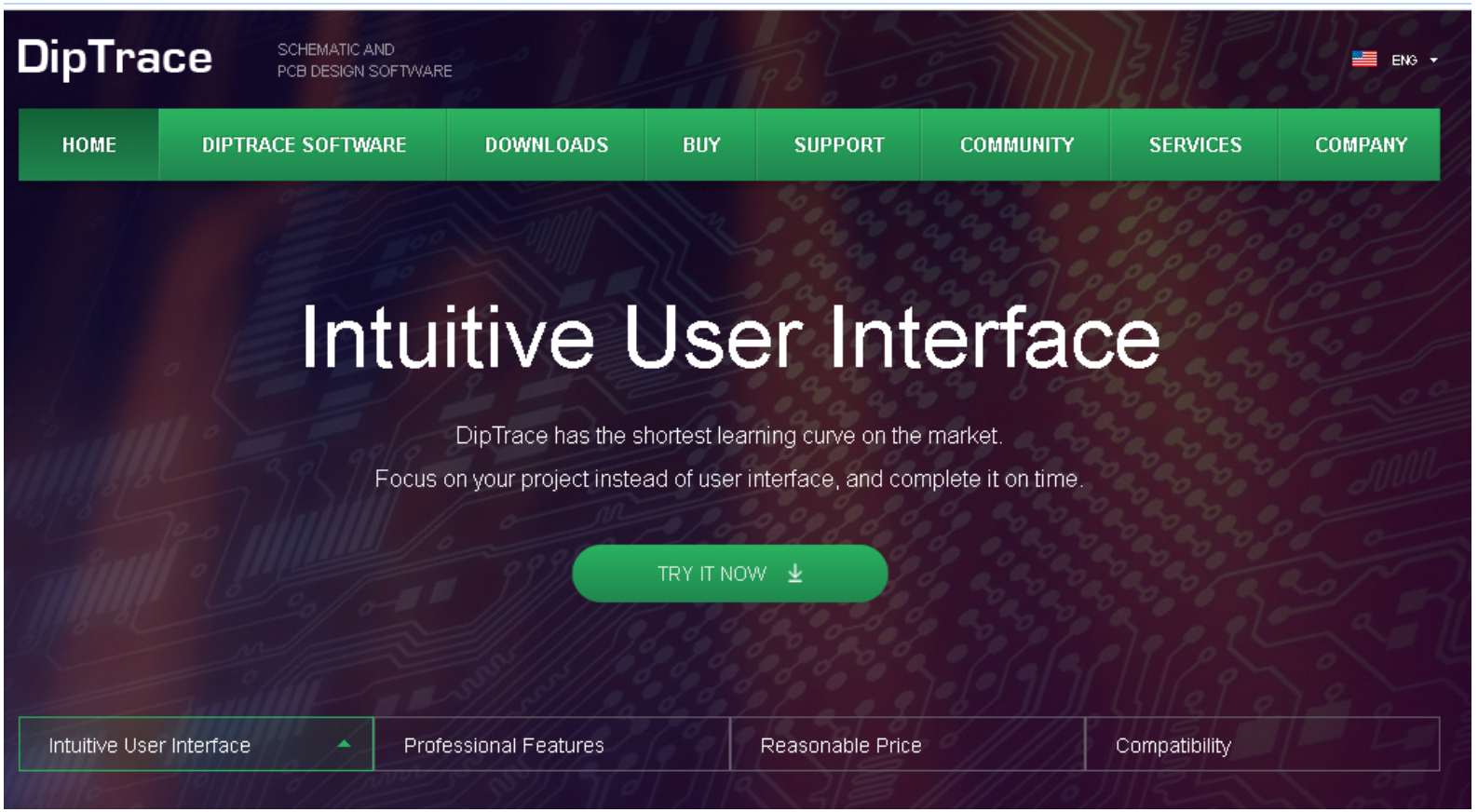
My PCBWay (0)
New here? Free for your first order!
Home
PCB Instant Quote
PCB Assembly
Advanced PCB
Product Center
Why Us?
Feedback
Capabilities
Shared Projects
Contact Us
PCB Prototype
SMD Stencil
PCB Assembly
Flexible PCBs
Advanced PCBs
Slide 2
Instant Quote
Full feature prototype PCB custom service at low cost.
Dimensions
Length
x
Width
mm
Quantity
Choose Num (pcs)
Layers
2 Layers
Thickness
1.6mm
Quote Now
Get $5.00 - Free Prototype Order
PayPal
Sale For SMT Order
ONLY $ 30
for SMT Prototype Order
Free Shipping,Free Stencil,
Just to verify our SMT service
FREE
$5.00
10 pcs 1-2 layer
Build Time:24 hours
$30
IN TOTAL
for 1-20pcs assembly
Best Value
Manufacturer Direct Pricing
24H
Fast Turnarounds
As fast as 24 hours
One-on-one assistance
Smooth shopping experience
News: 12-11 Merry Christmas and Happy New Year!!! More than 10K P...
PCBWay, PCB Prototype the Easy Way
With more than A decade in the field of PCB prototype and ...
Learn Mo
Contact us
Type here to search
7:38 AM
2/18/2020

Get you going

- Purpose of talk is to get you set up to use this kind of service.
- DHL shipping -- boards typically on my doorstep SIX DAYS after order.
- 10 boards for $25-ish.

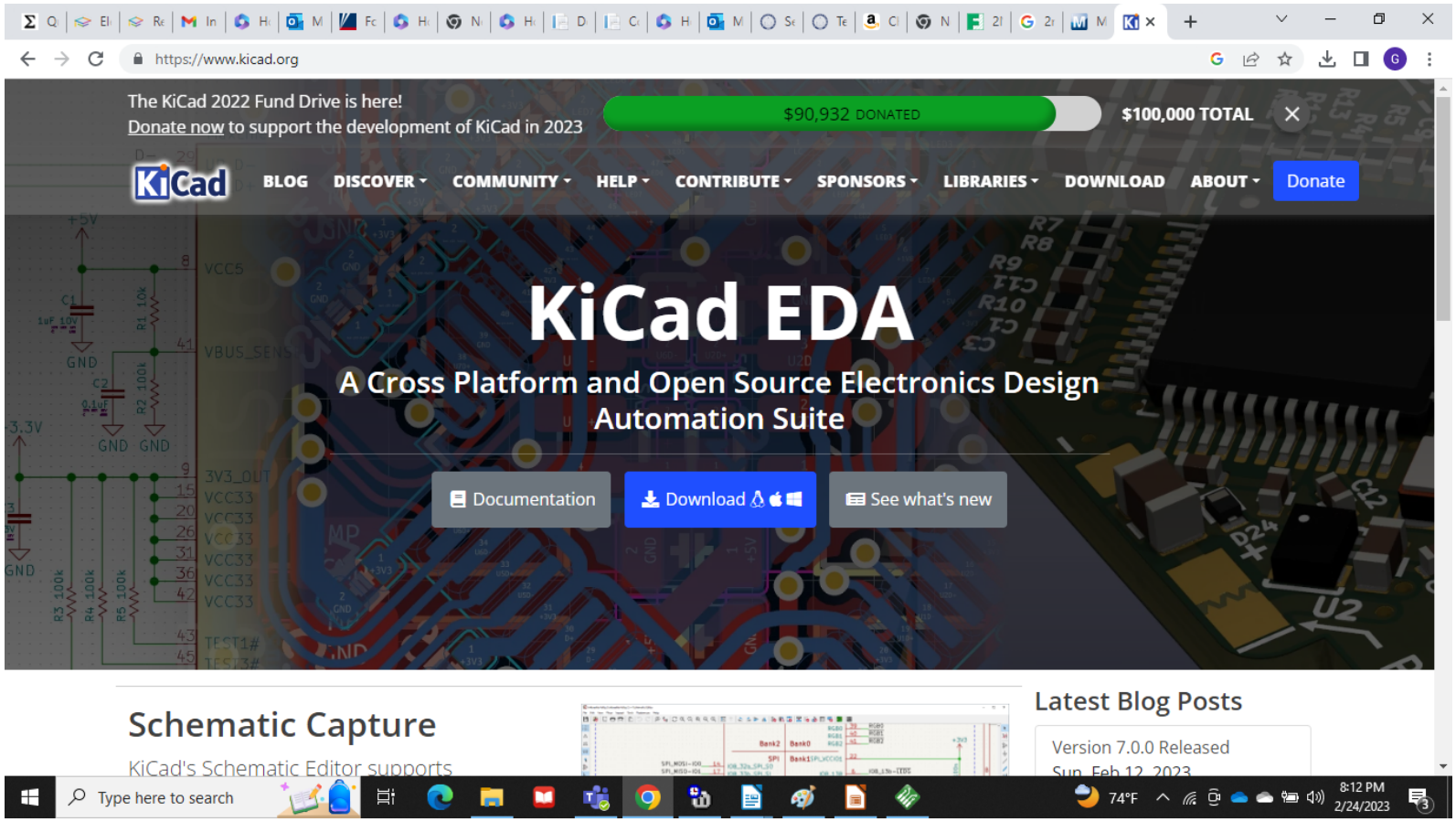
Multiple free layout programs

- https://diptrace.com/
-



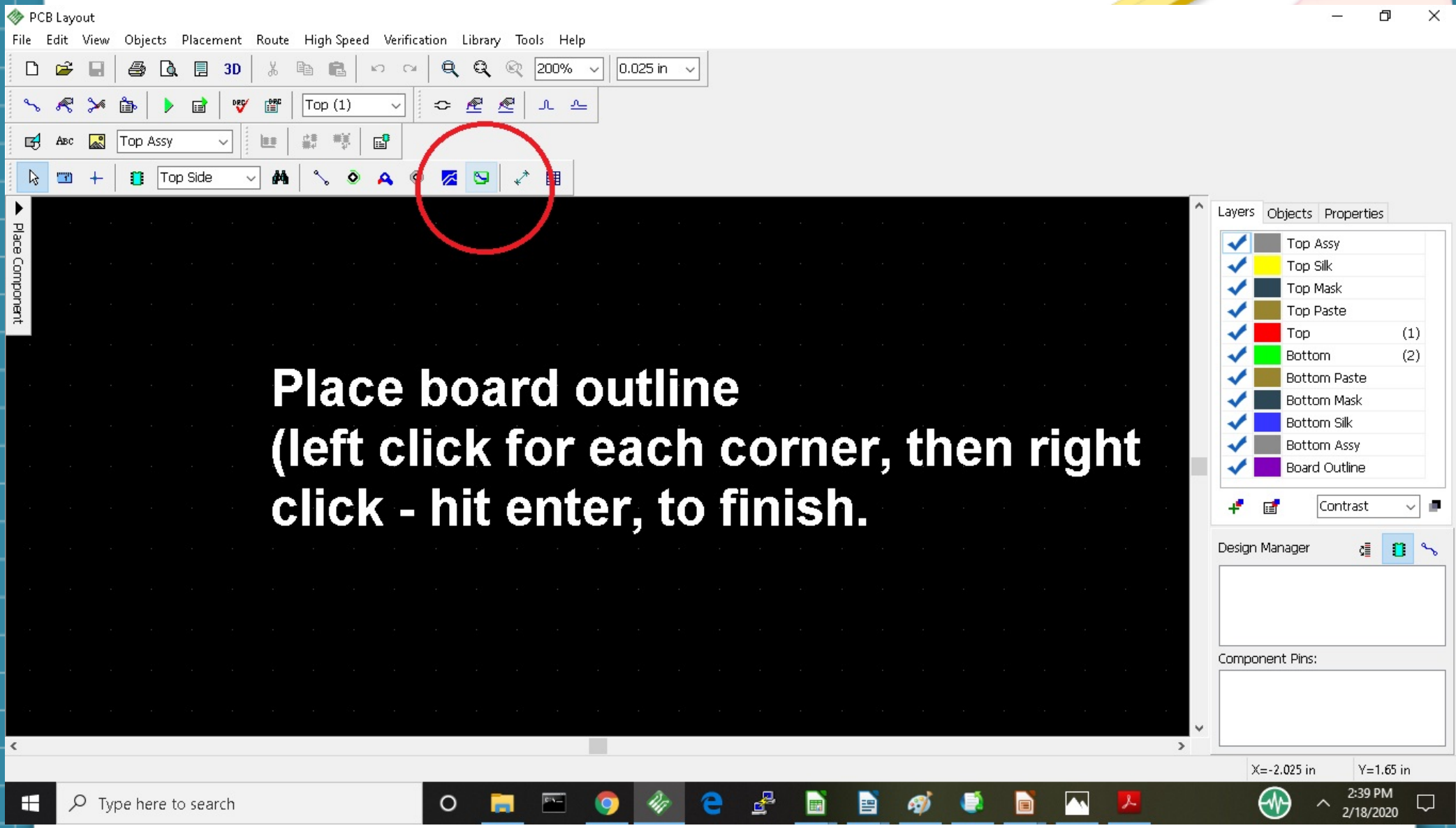
KICAD

- Ashhar's preference
- Used for lots of people

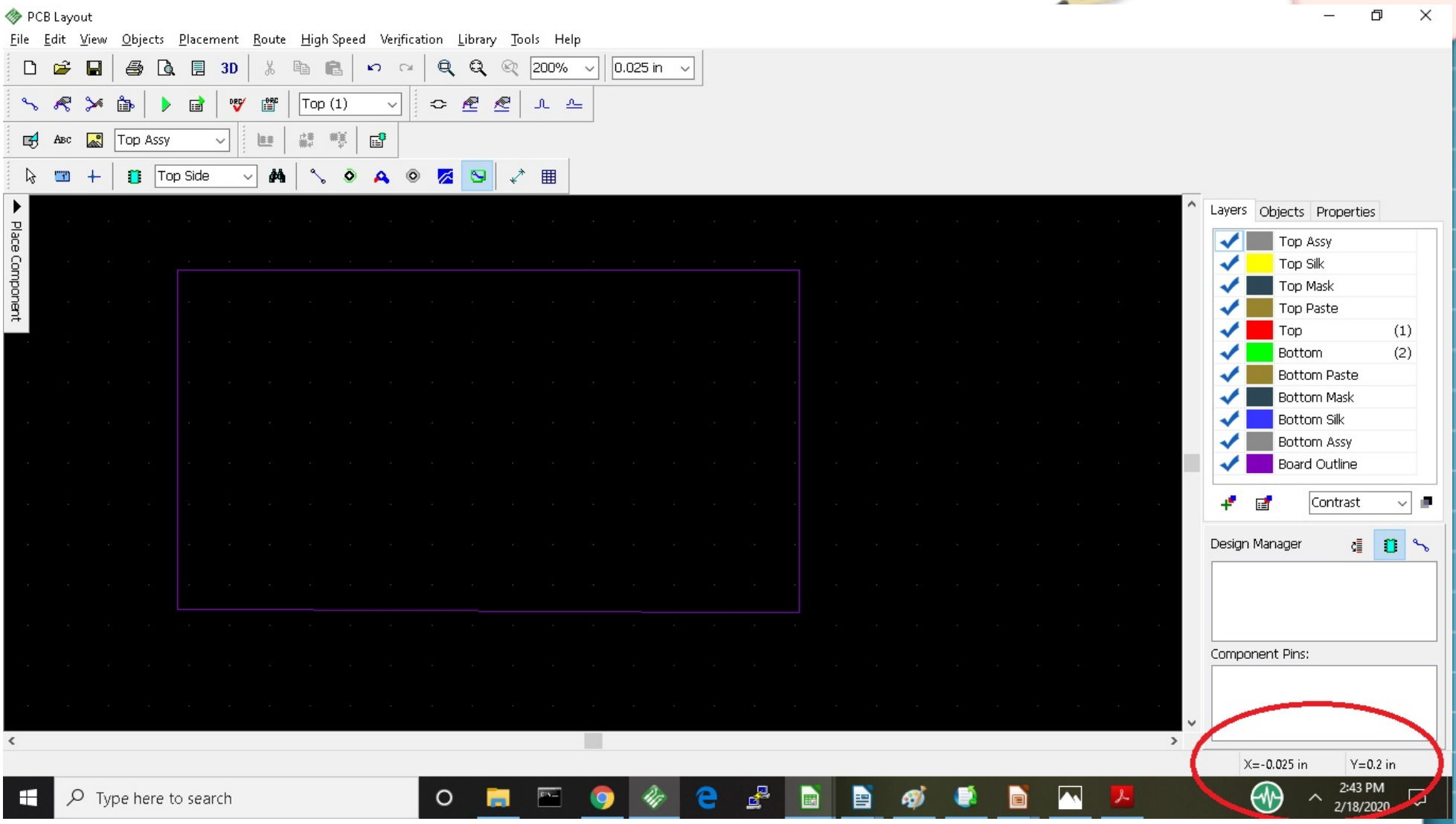


Limitations

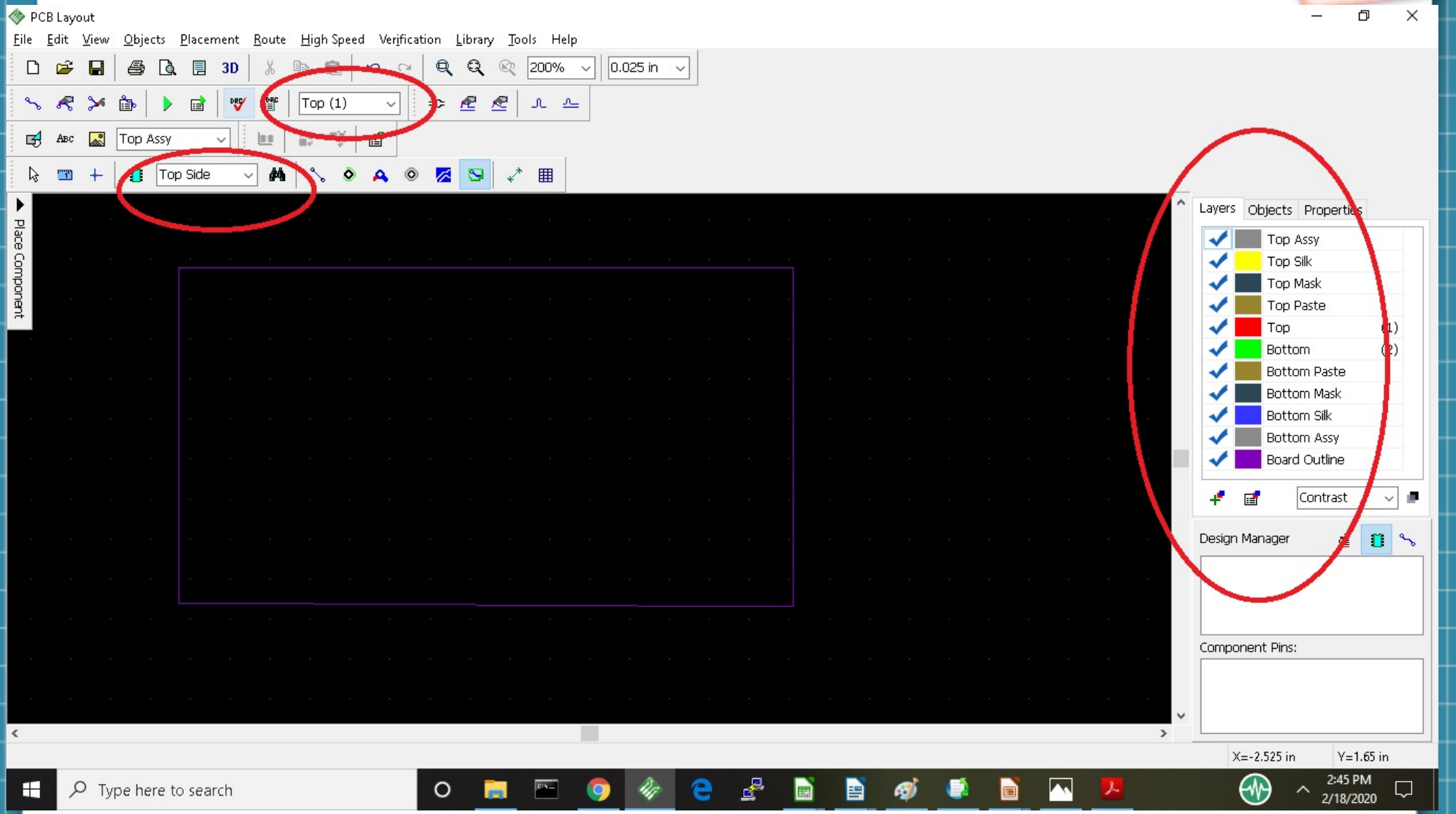
- DIPTRACE (cheapest)
- (Alternatives:
- 2 layer boards
- Auto layout possible….manual is easy.
- Simple copper pours


PCB Layout
File Edit View Objects Placement Route High Speed Verification Library Tools Help
3D
200%
0.025 in
Top (1)
Top Assy
Top Side
Place Component
Place board outline
(left click for each corner, then right
click - hit enter, to finish.
Layers Objects Properties
Top Assy
Top Silk
Top Mask
Top Paste
Top (1)
Bottom (2)
Bottom Paste
Bottom Mask
Bottom Silk
Bottom Assy
Board Outline
Contrast
Design Manager
Component Pins:
X=-2.025 in
Y=1.65 in
Type here to search
2:39 PM
2/18/2020

(x,y) of mouse position

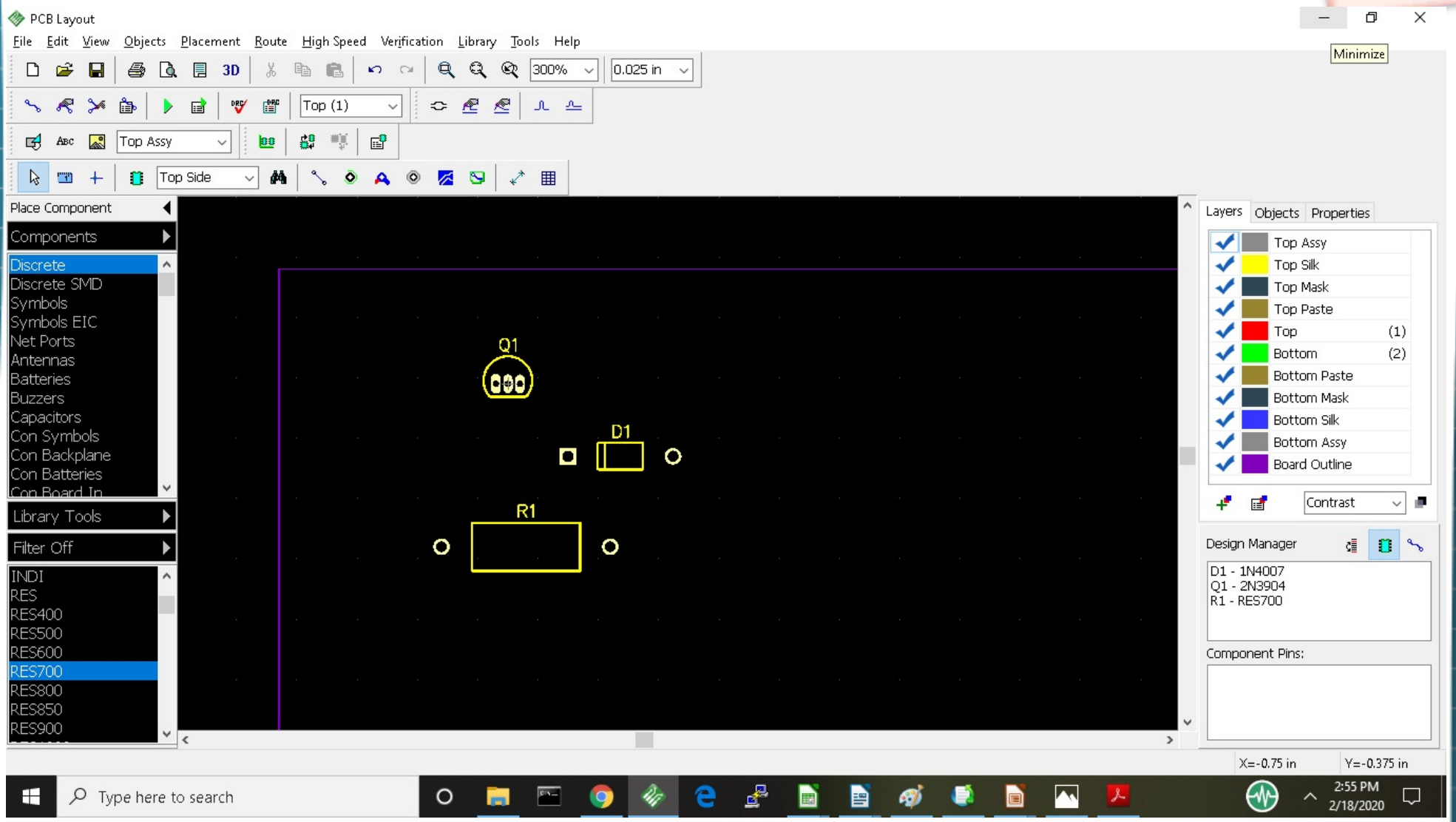


Layers - components, traces, views

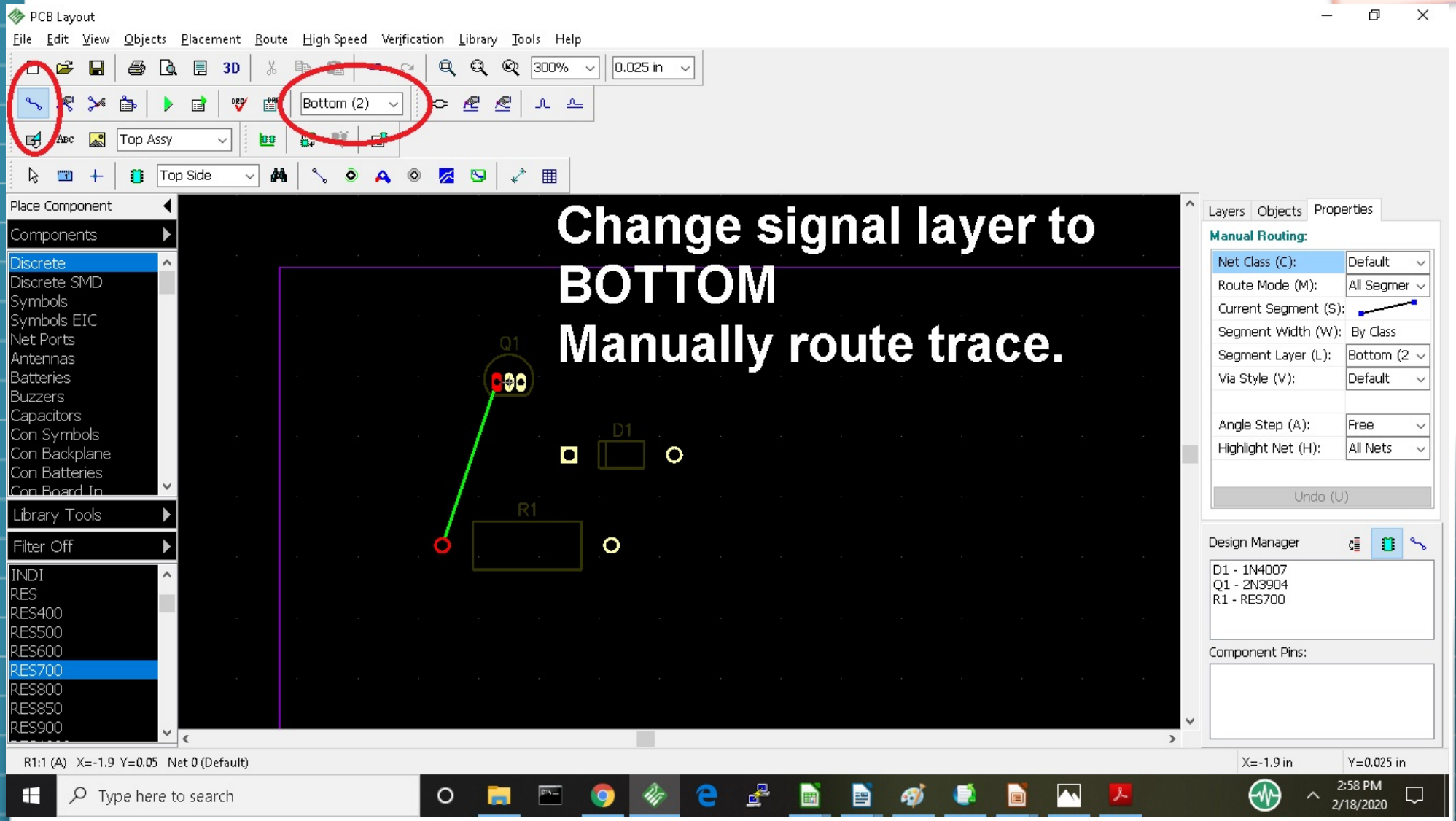


- COMPONENTS
  - Discrete -- includes C's and R's
  - Transistors -- lots of good ones
  - Diodes -- lots of good ones
  - Work: You will have to **find** everything you want.
  - You can "reuse" any set of pads that match your need.
  - You can modify or create a template
  - Uploading is possible

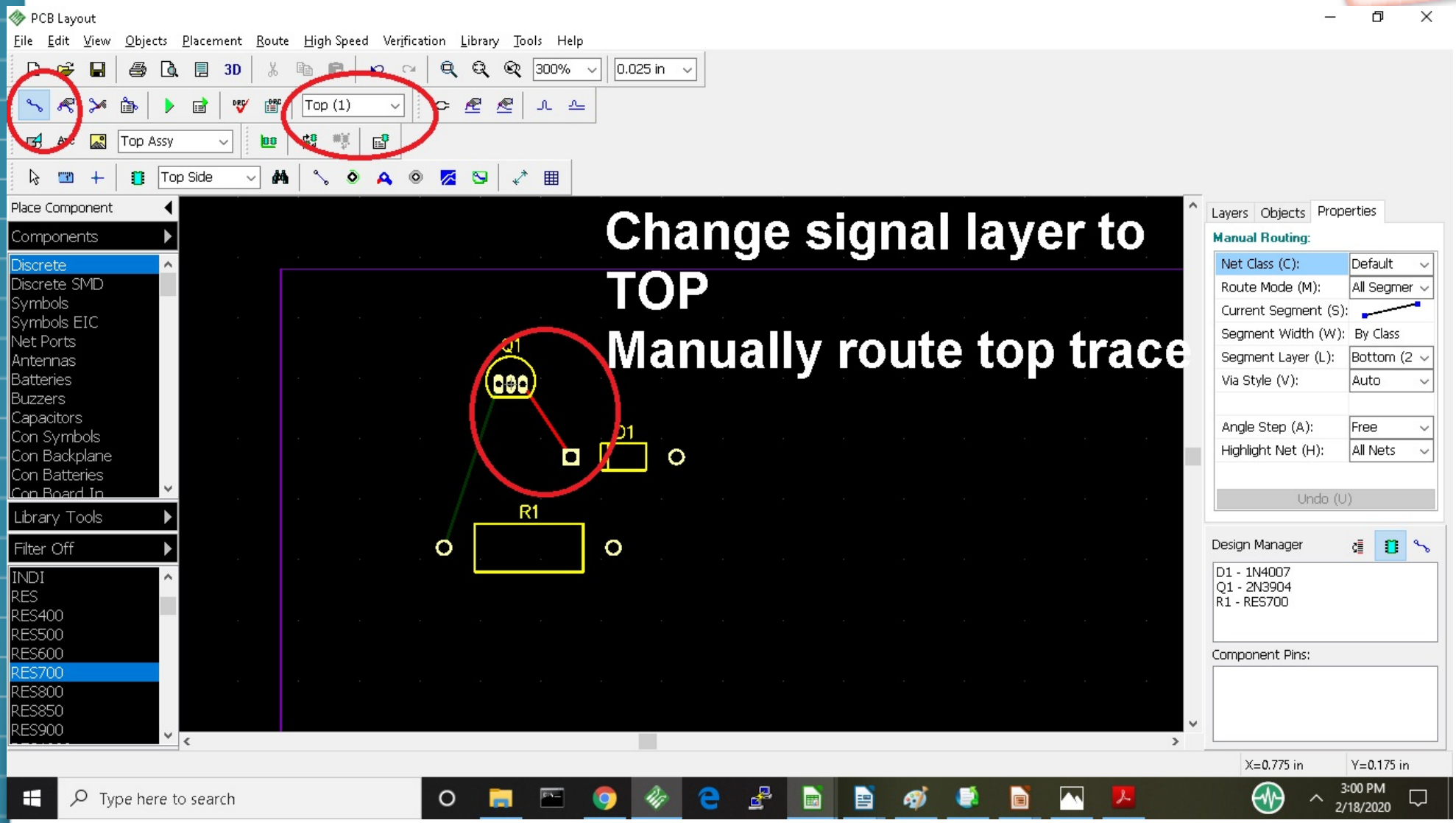
Put components on top side



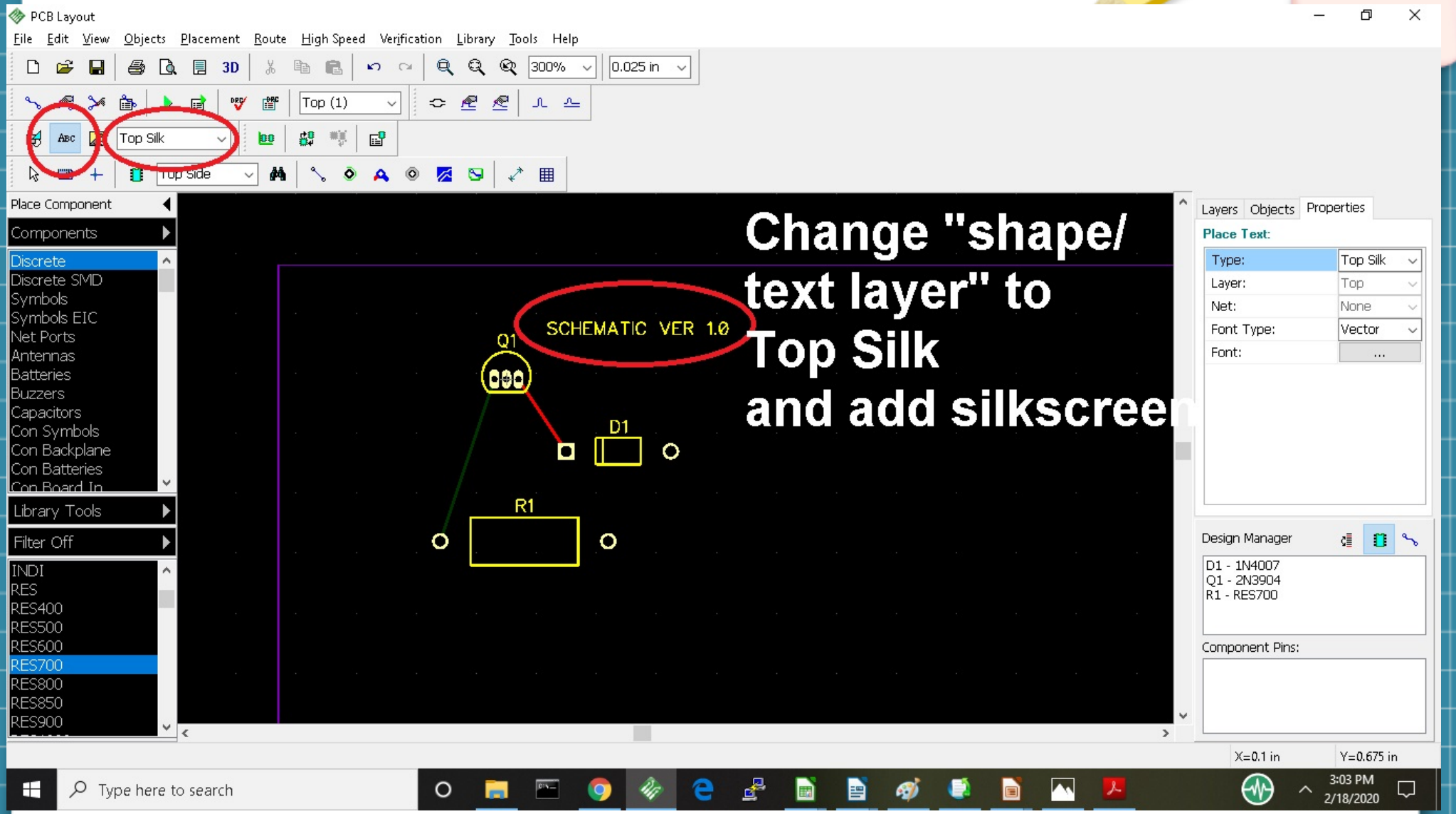
Manual bottom side trace



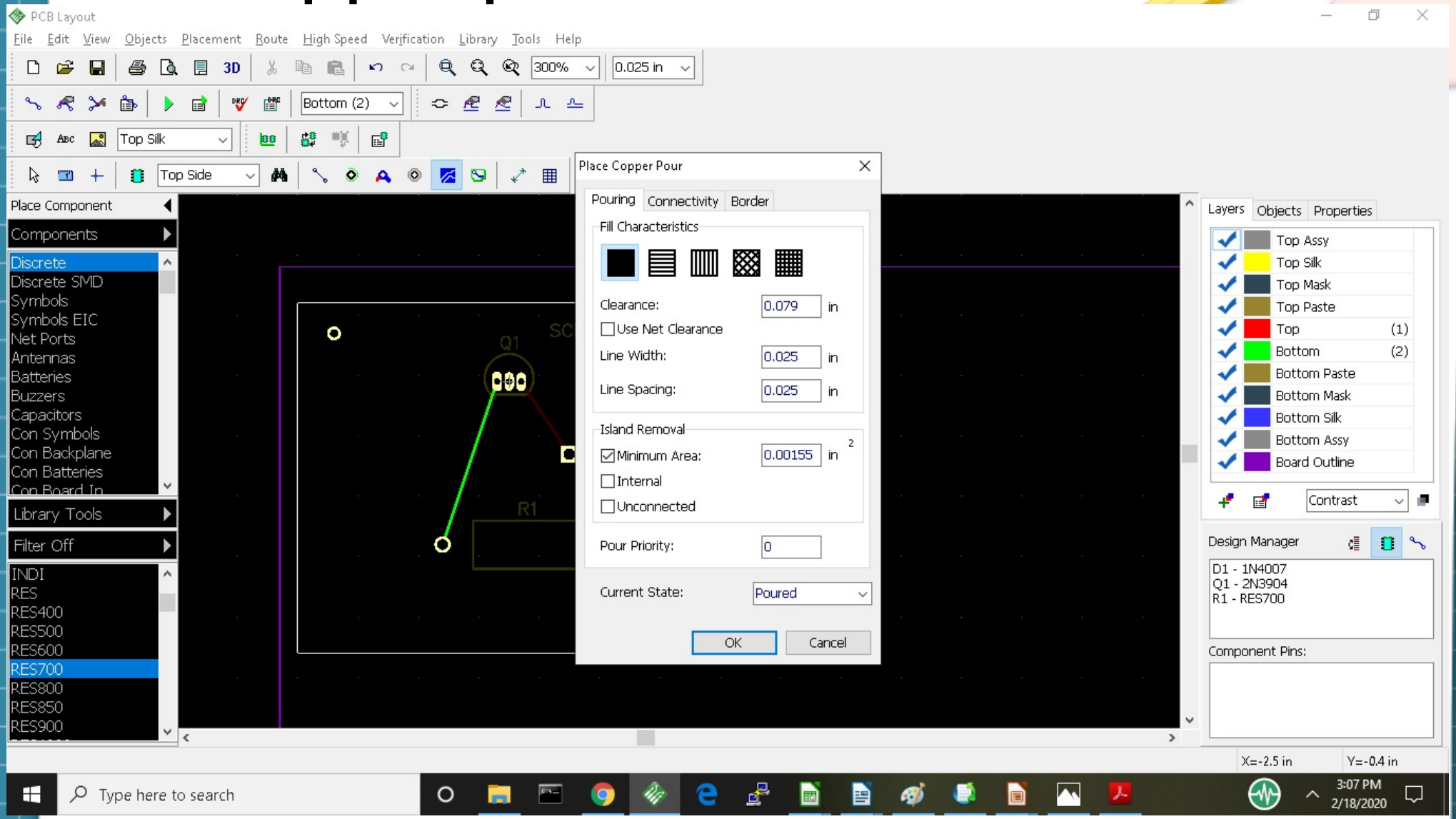
Manual top layer trace



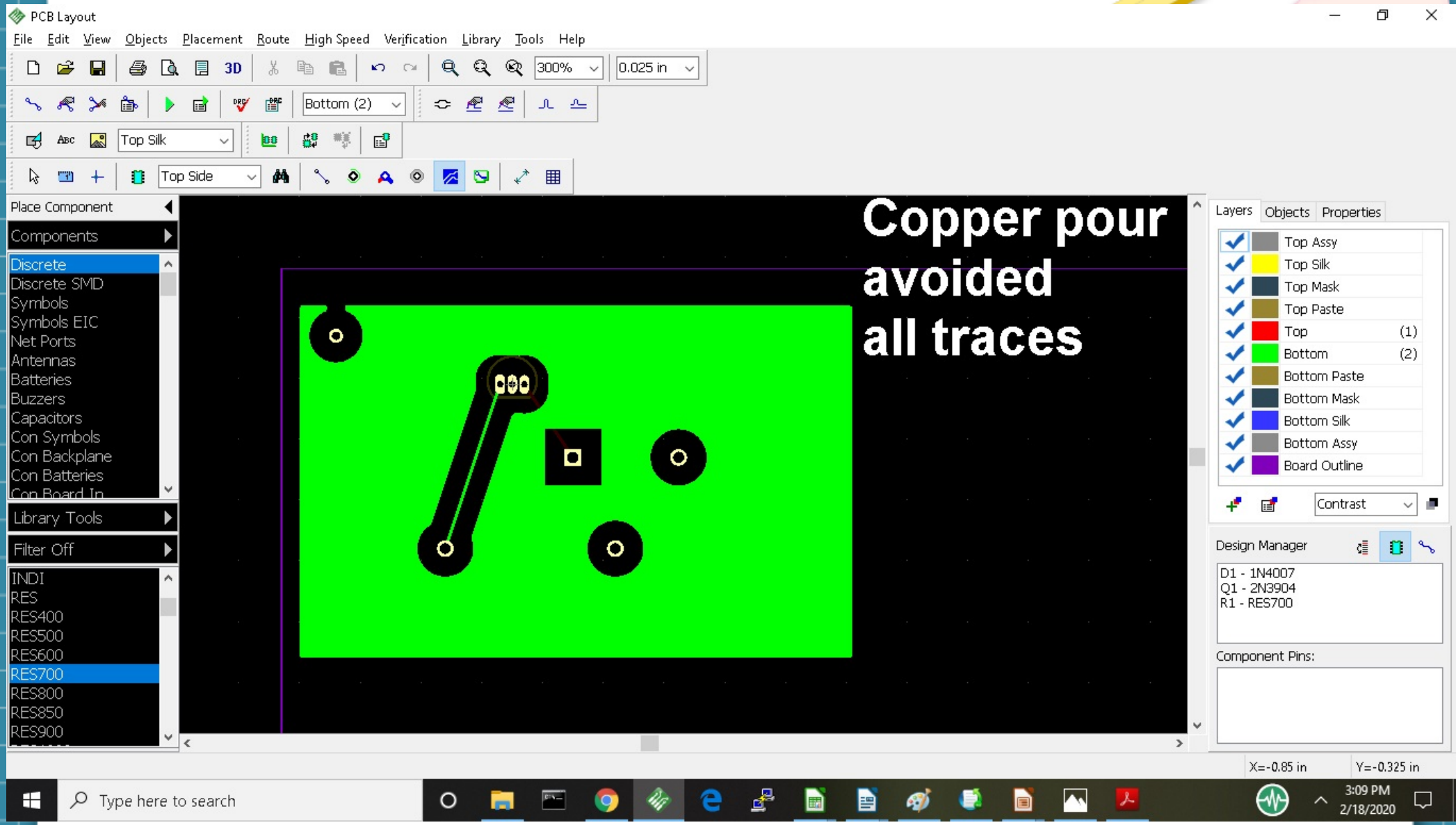
Silkscreen


PCB Layout
File Edit View Objects Placement Route High Speed Verification Library Tools Help
Top (1)
Top Silk
Top Side
Place Component
Components
Discrete
Discrete SMD
Symbols
Symbols EIC
Net Ports
Antennas
Batteries
Buzzers
Capacitors
Con Symbols
Con Backplane
Con Batteries
Library Tools
Filter Off
INDI
RES
RES400
RES500
RES600
RES700
RES800
RES850
RES900
SCHEMATIC VER 1.0
Q1
D1
R1
Change "shape/ text layer" to Top Silk and add silkscreen
Layers Objects Properties
Place Text:
Type: Top Silk
Layer: Top
Net: None
Font Type: Vector
Font: ...
Design Manager
D1 - 1N4007
Q1 - 2N3904
R1 - RES700
Component Pins:
X=0.1 in
Y=0.675 in
Type here to search
3:03 PM
2/18/2020

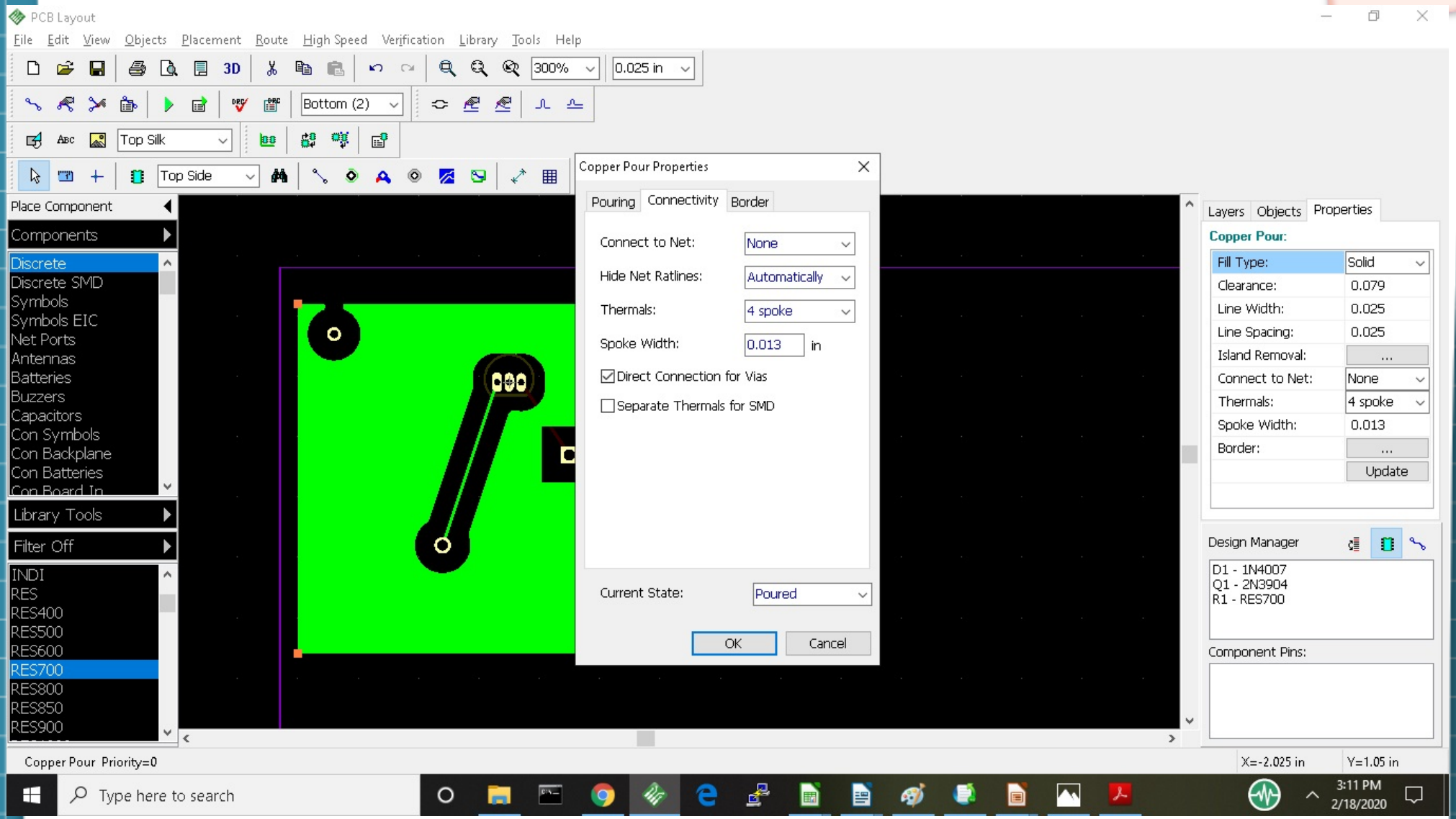
copper pour: like board outline



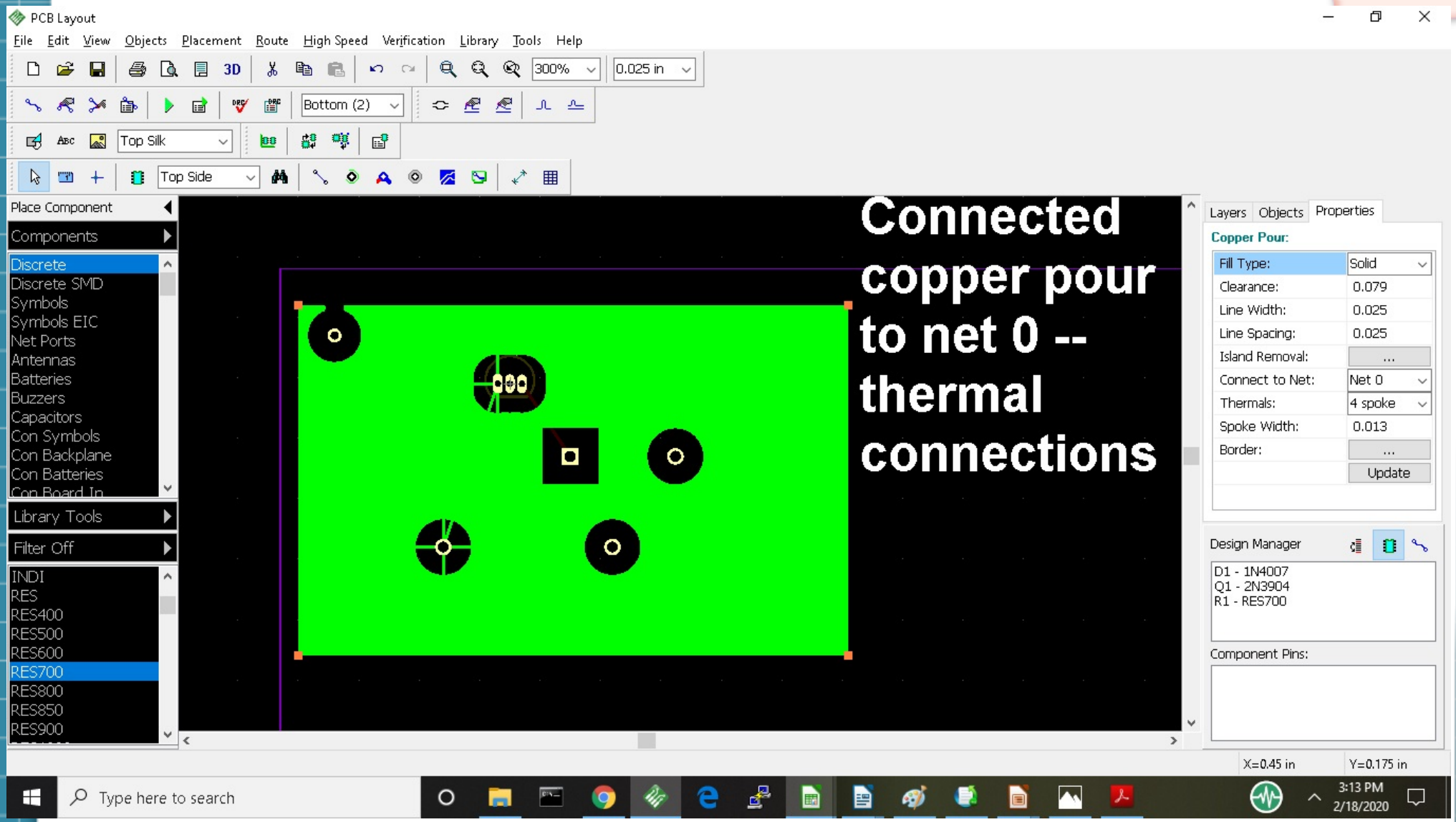
avoids traces



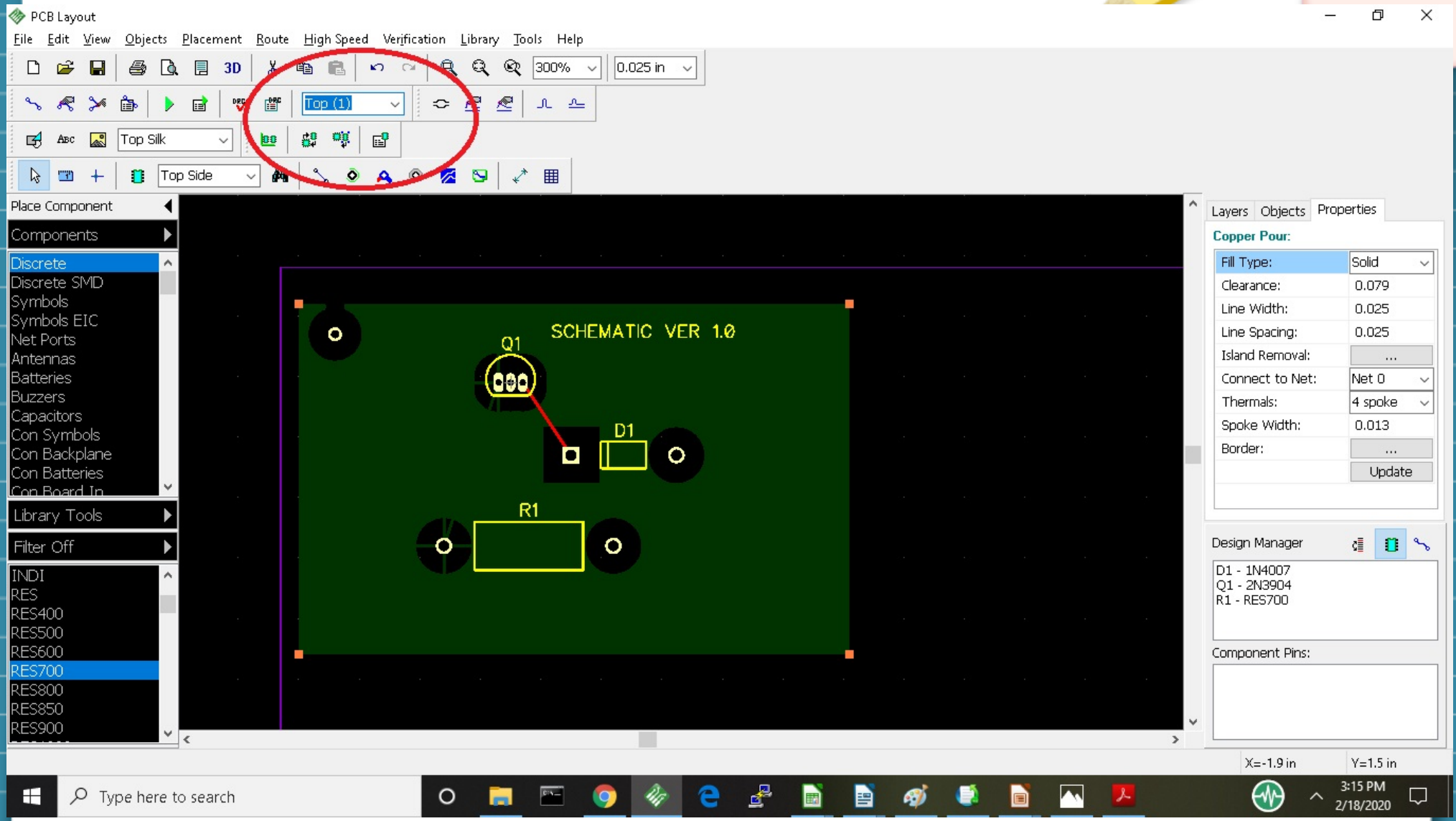
Right-Click Properties: not conn.



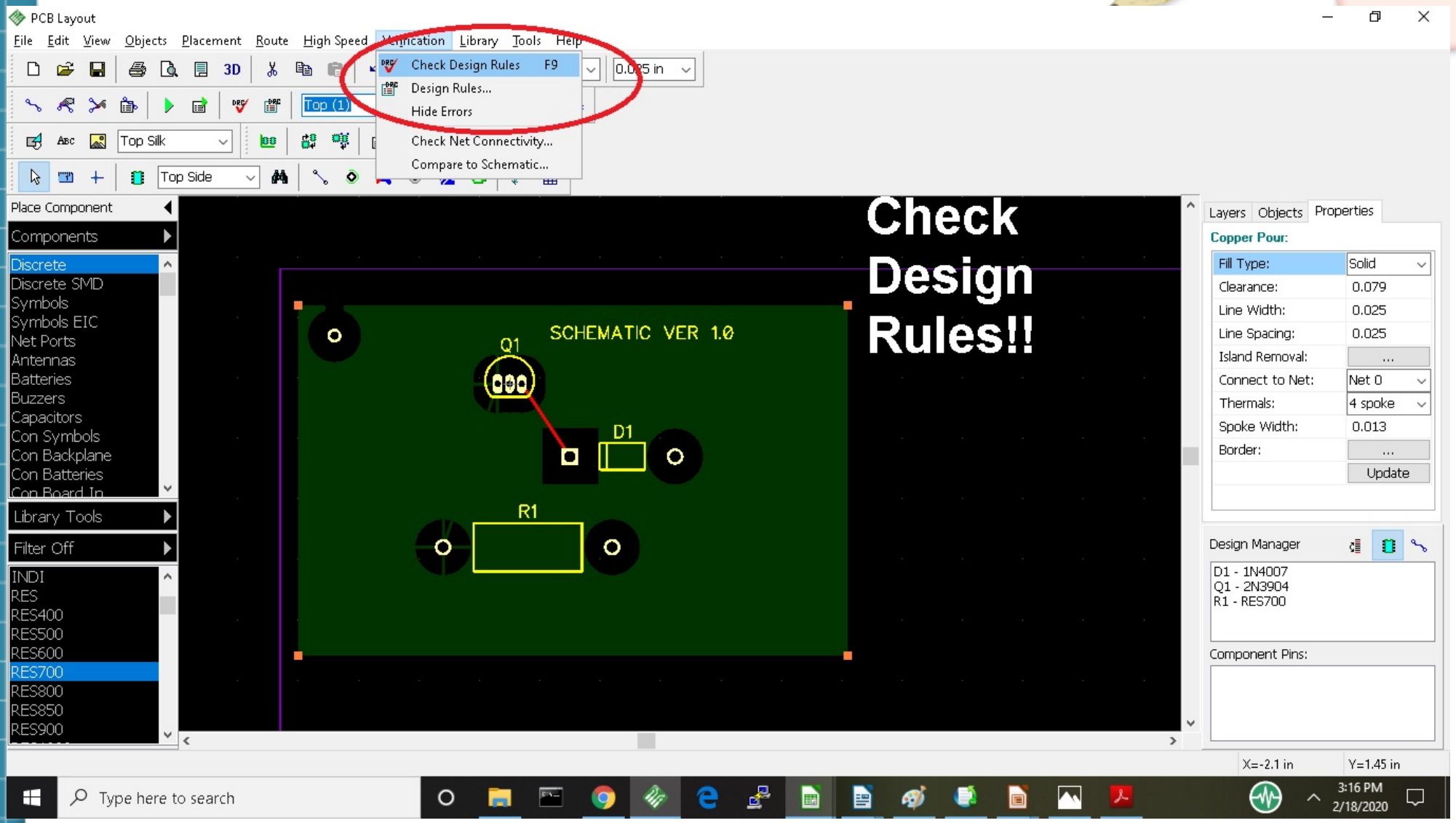
connect pour to net 0



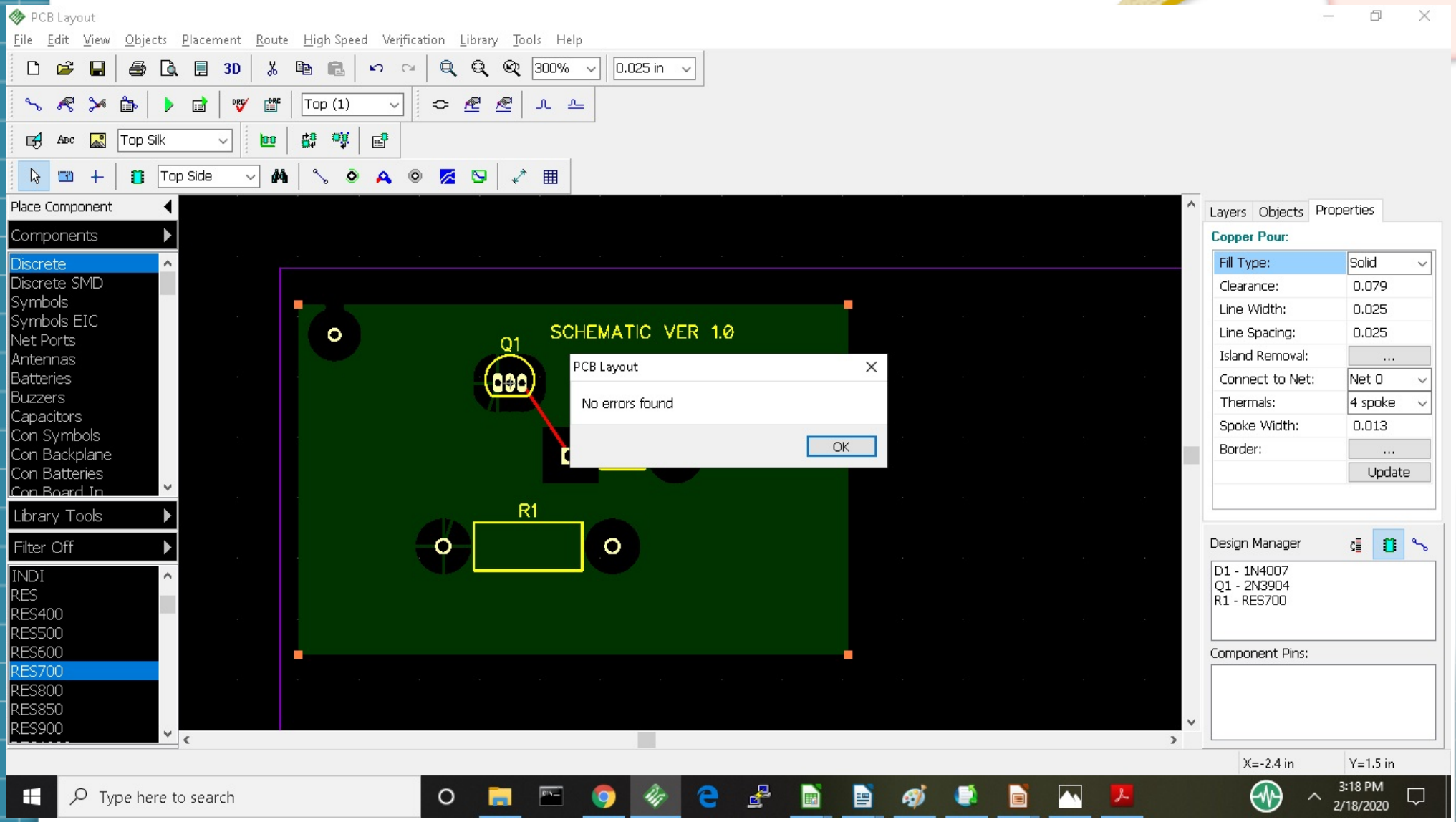
back to top view



check design rules!



No errors!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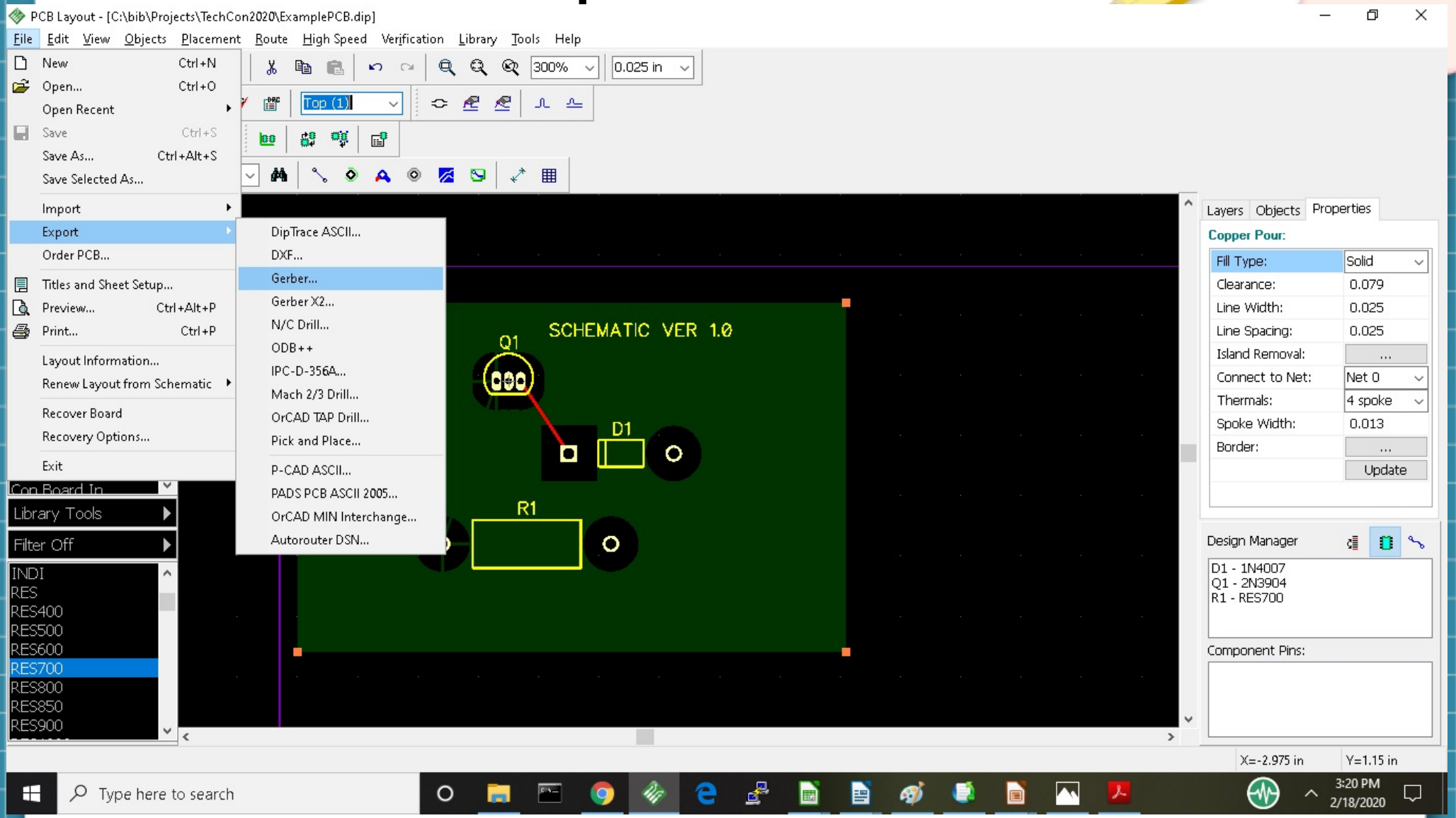
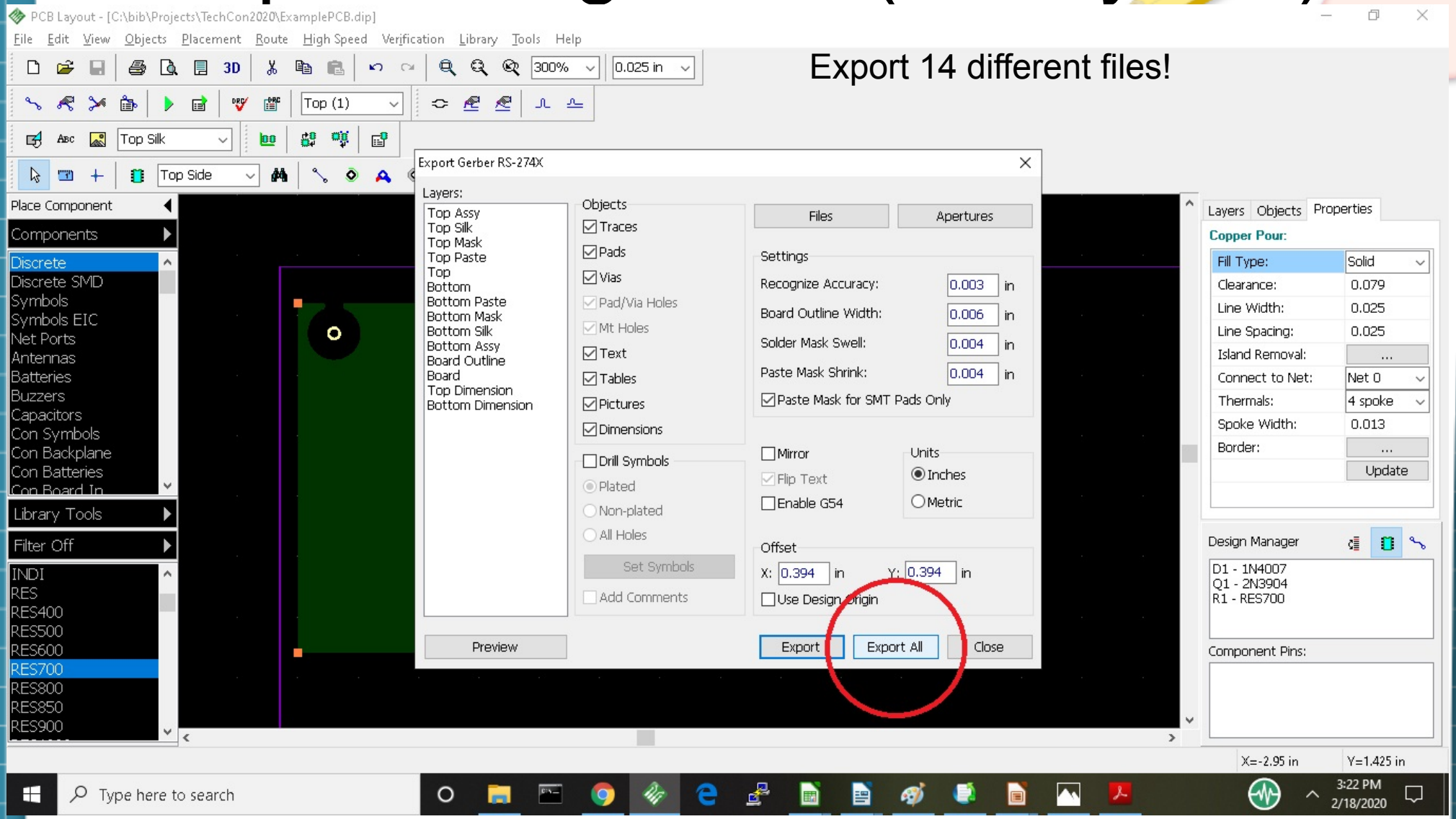
Library Tools
Filter Off
INDI
RES
RES400
RES500
RES600
RES700
RES800
RES850
RES900
SCHEMATIC VER 1.0
Q1
R1
PCB Layout
No errors found
OK
Layers Objects Properties
Copper Pour:
Fill Type: Solid
Clearance: 0.079
Line Width: 0.025
Line Spacing: 0.025
Island Removal: ...
Connect to Net: Net 0
Thermals: 4 spoke
Spoke Width: 0.013
Border: ...
Update
Design Manager
D1 - 1N4007
Q1 - 2N3904
R1 - RES700
Component Pins:
X=-2.4 in
Y=1.5 in
Type here to search
3:18 PM
2/18/2020

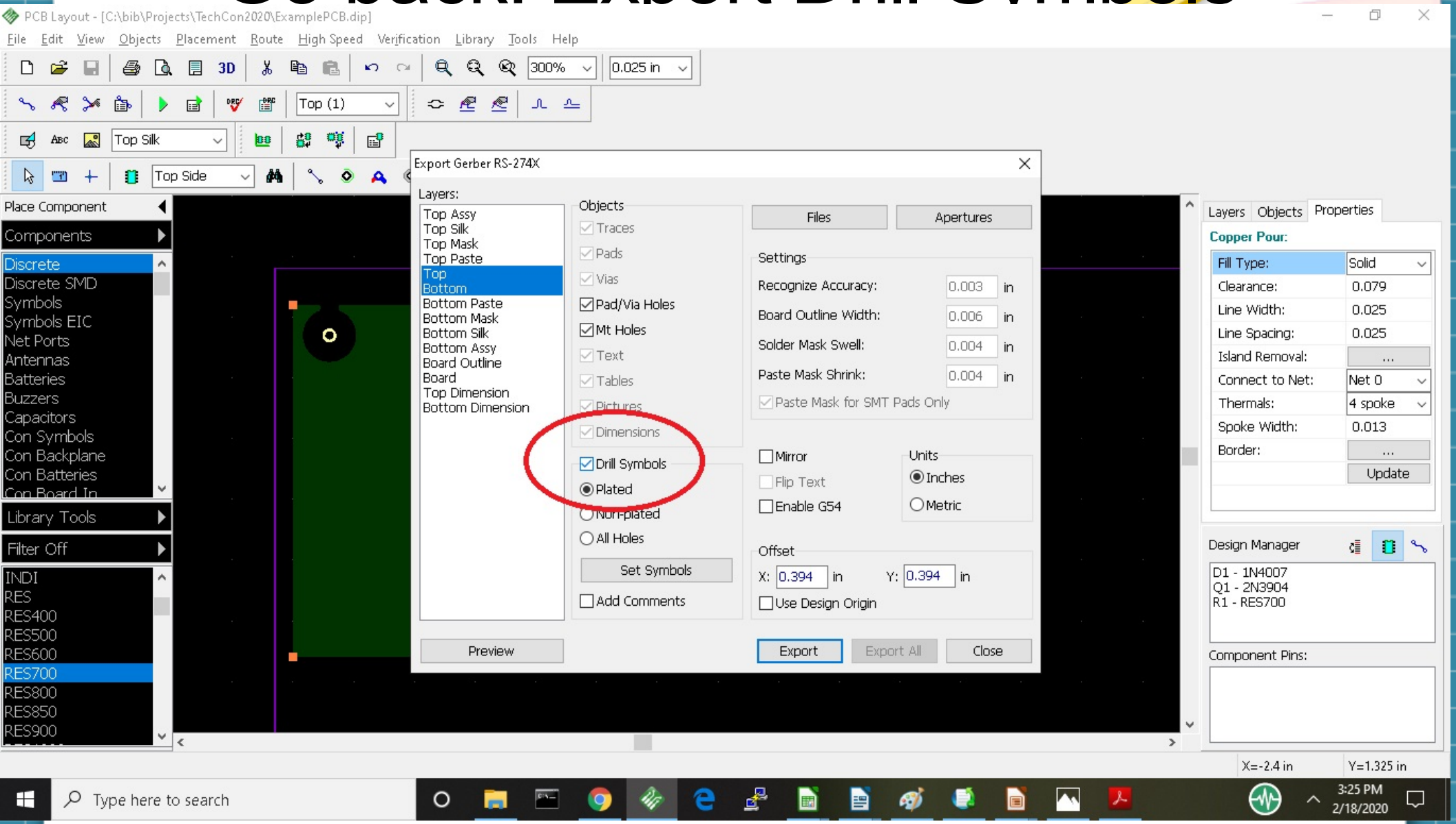
Export:Gerber



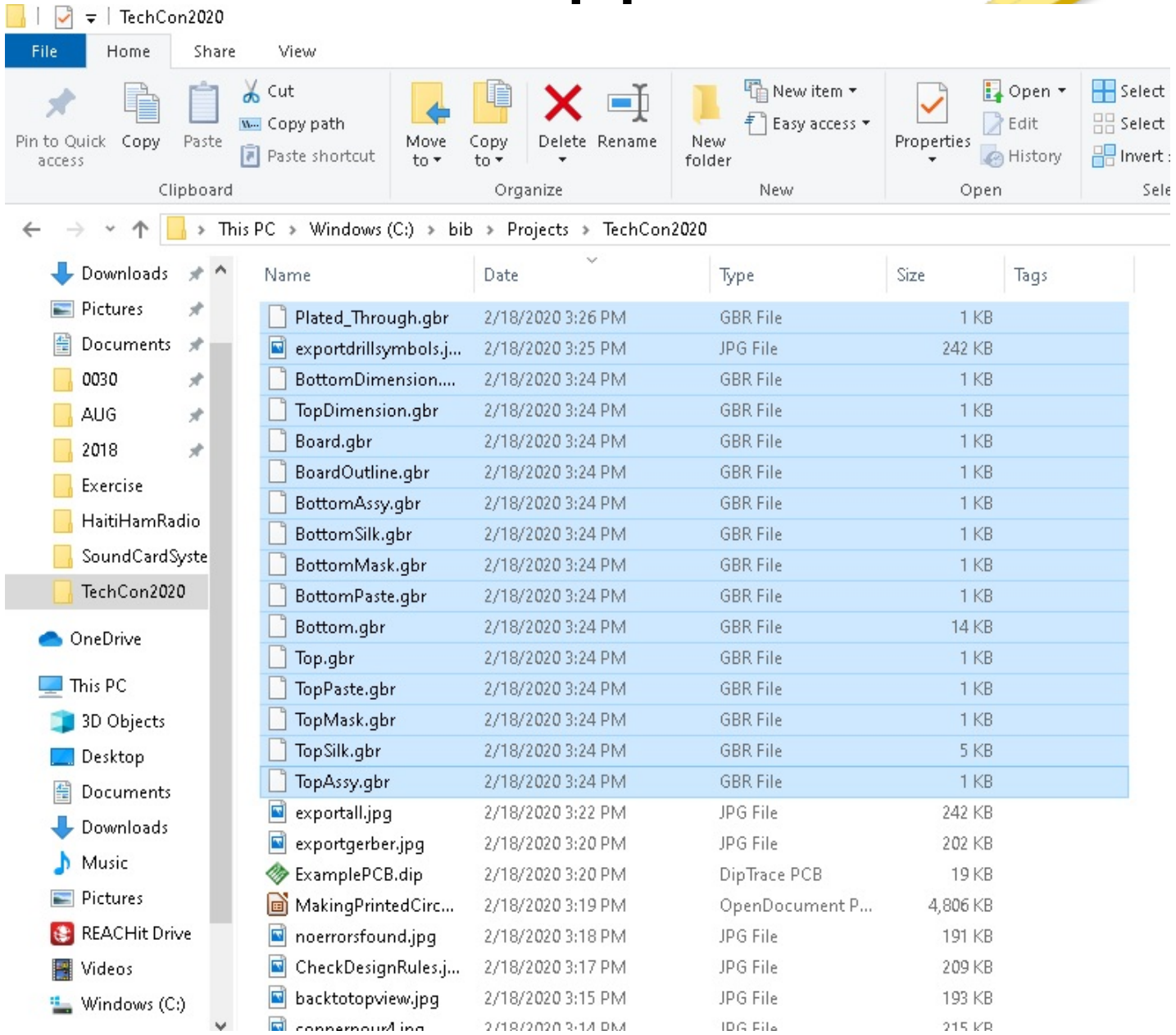
Export ALL gerbers (one by one)



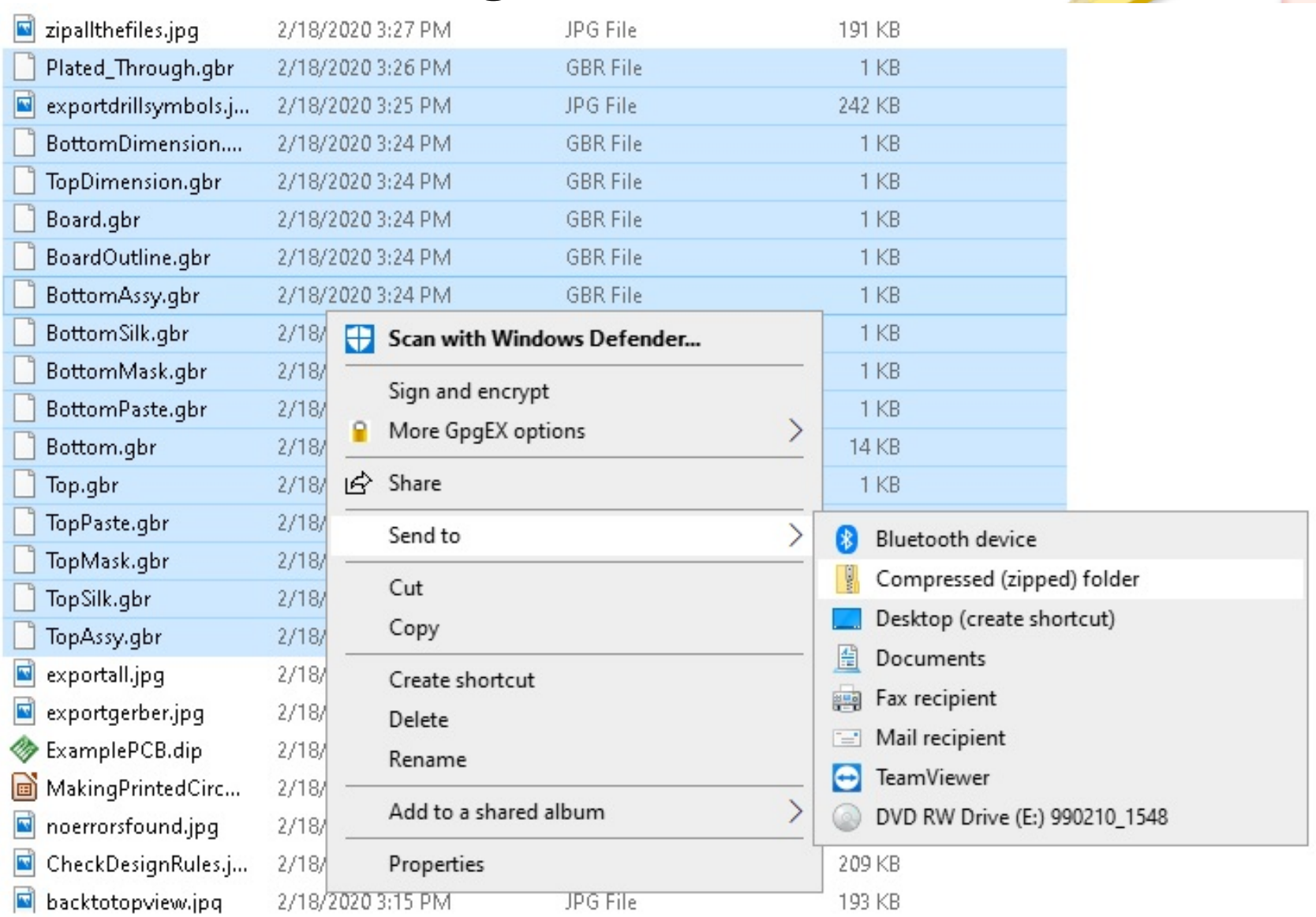
Go back: Export Drill Symbols



send all to zipped folder



Select, Right Click, Send To:

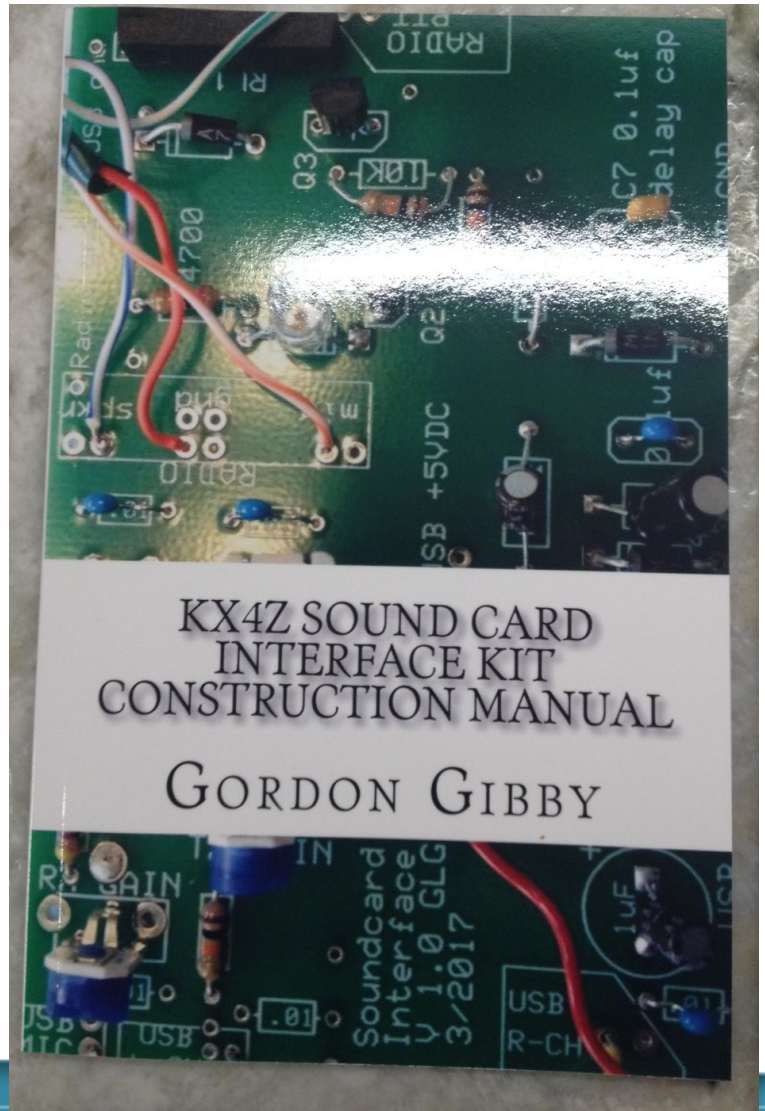


Send to China

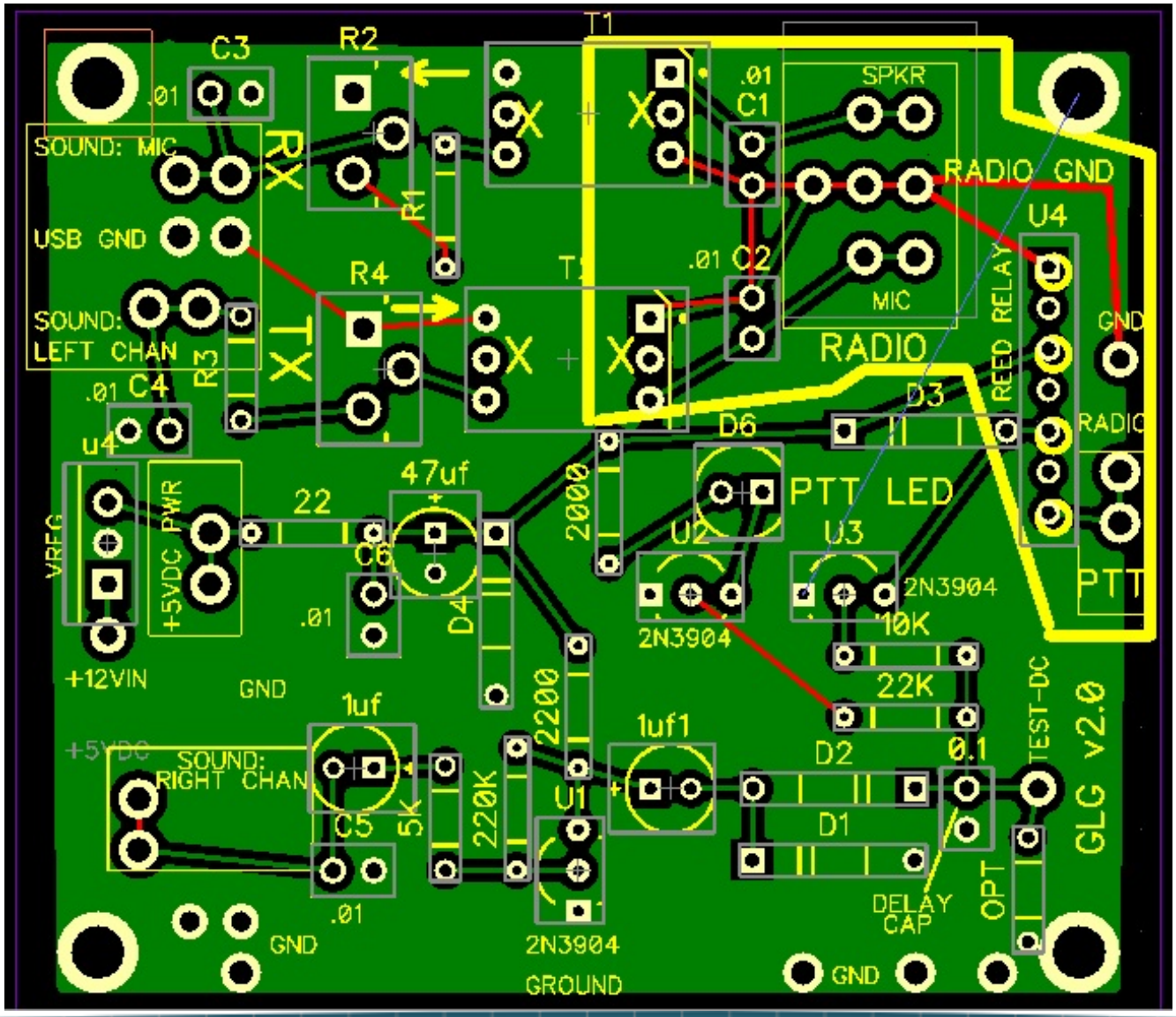
- Need to know SIZE OF BOARD
- Choose 2 layer, take defaults
- Upload your zipped file
- They will review for minutes/hours
- If missing file they will ask
- USE PAYPAL!!!!!!! O N L Y

Successful projects

- (manuals can be created with Kindle Direct Publishing)

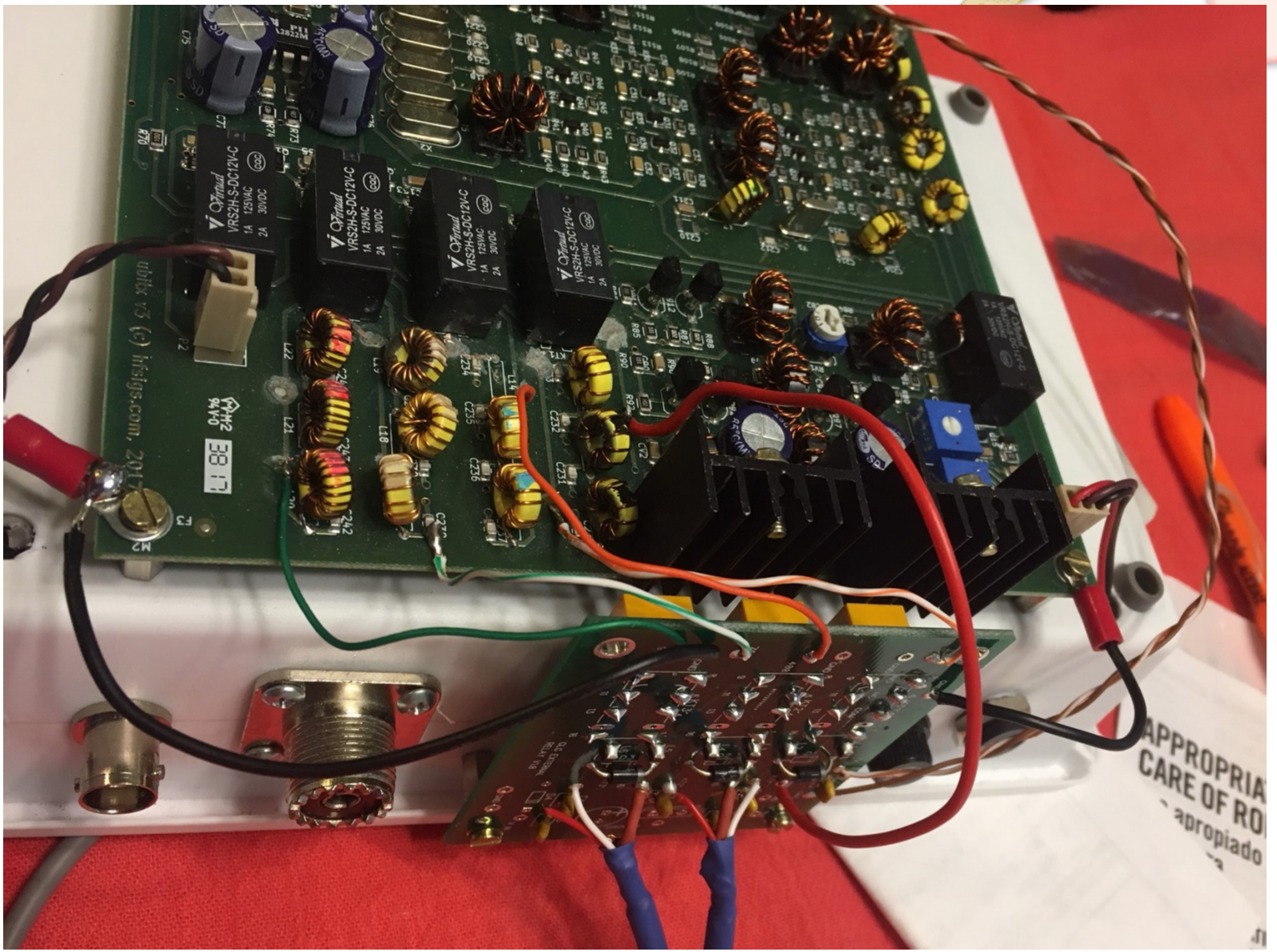


Sound Card Interface

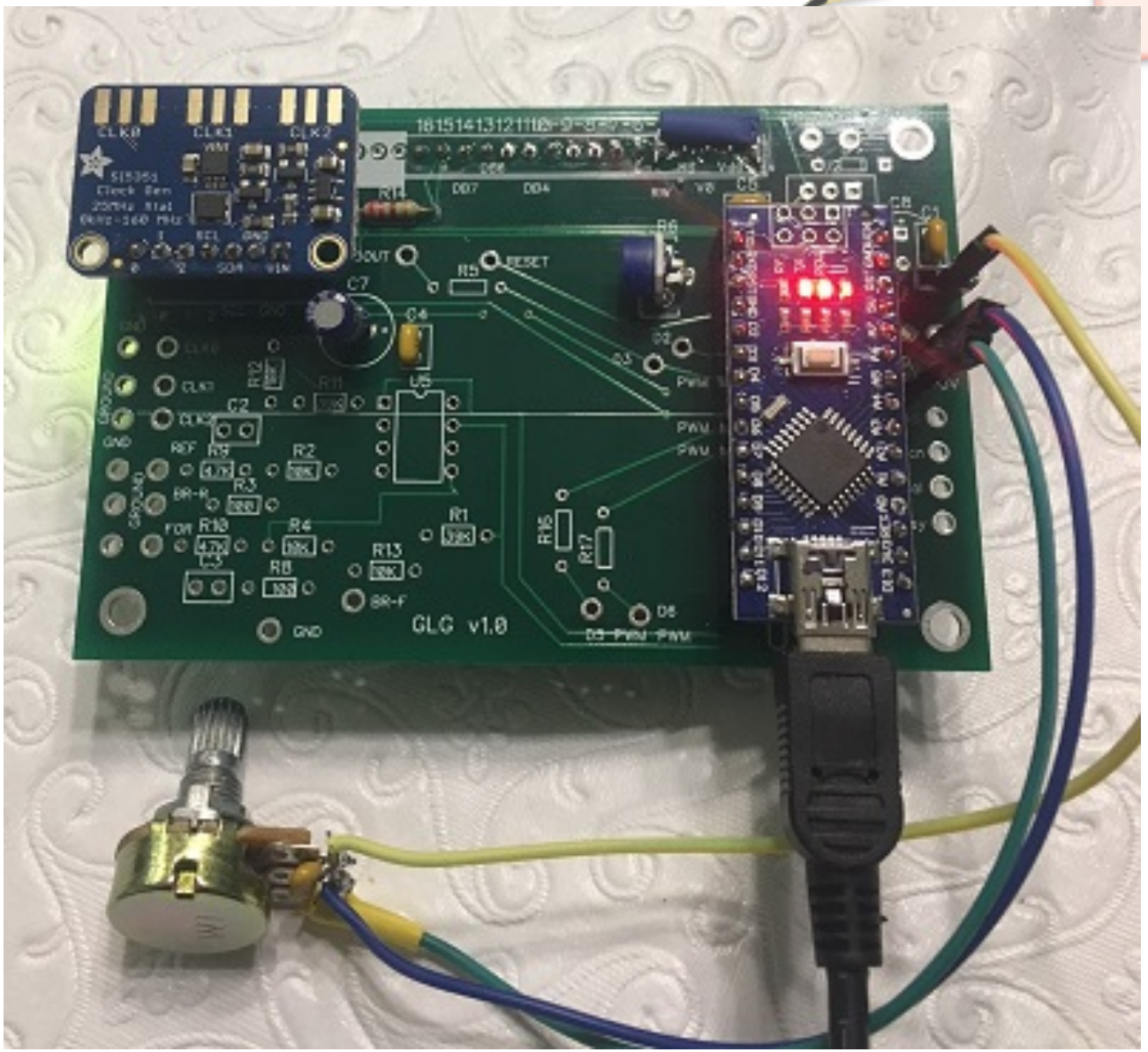


Very cheap enclosure!

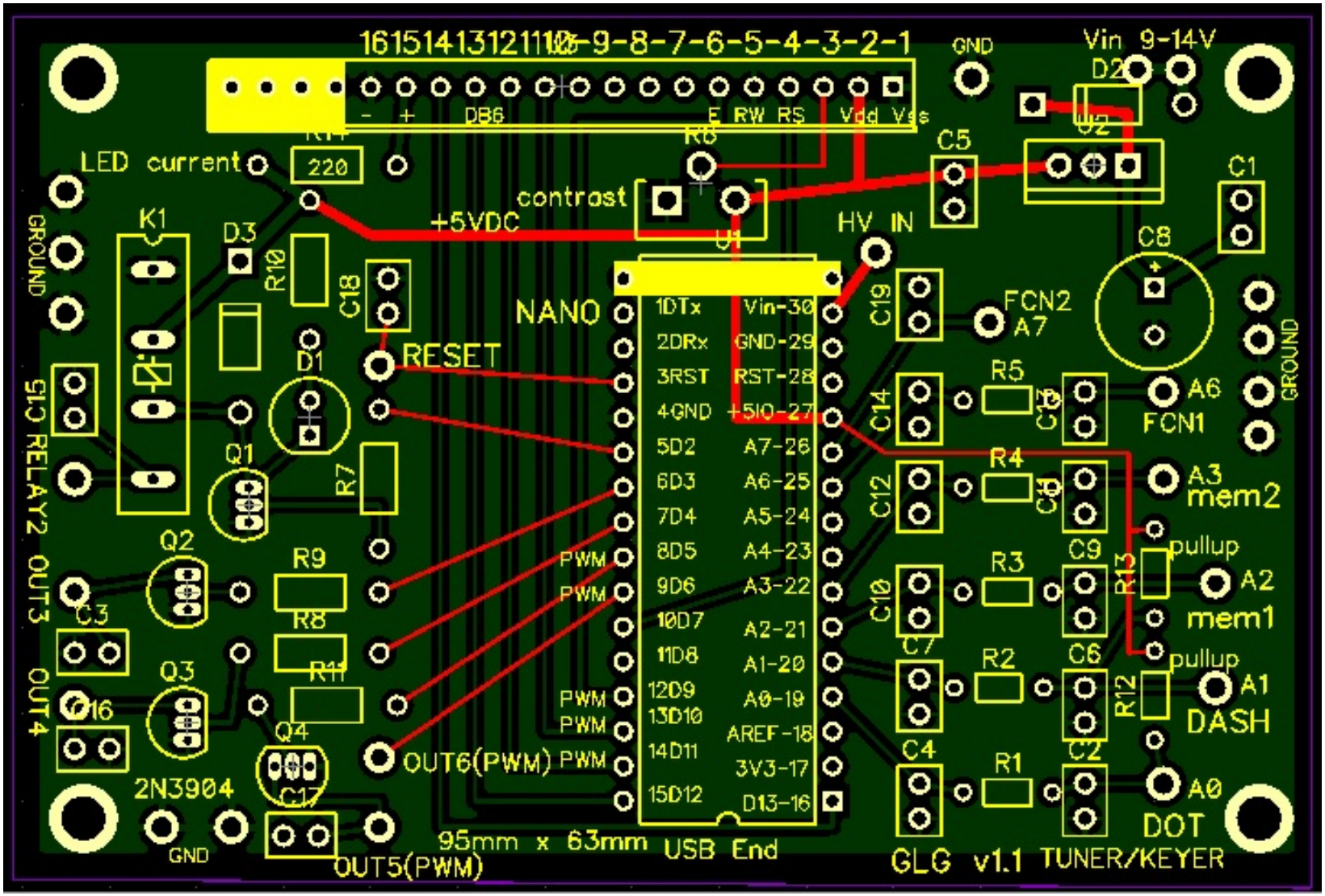
harmonic relay board



“Raduino” or SWR meter



Tuner-Keyer (Gen. Purpose)

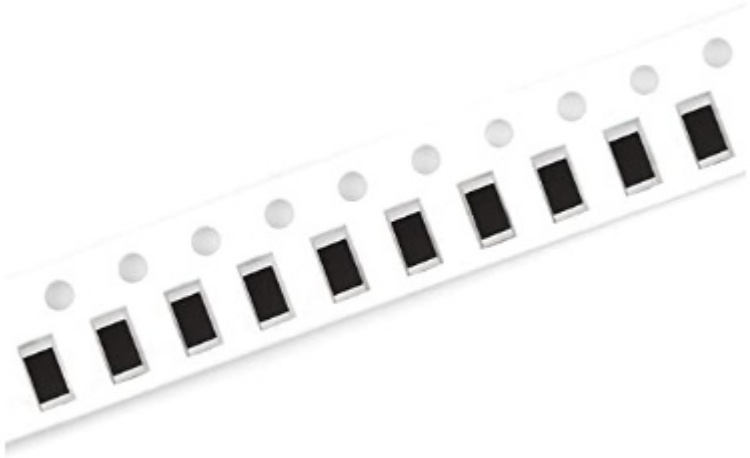


Thru-Hole Components Disappearing

- Much harder to find MOSFETS etc, number and quantity declining
- Vast choices now in tiny SMD devices

RESISTORS

- Resistors 1206 (inch) size
- 1200 / $10.00 *< 1 cent each*
- ¼ W
- https://www.amazon.com/dp/B08RYMYWG9



Chip Capacitors

- Capacitors, 1206 size (“inch”) 320/$9
- 10 pf – 22 uF (25V)
- https://www.amazon.com/dp/B06XDHC93D

ChipQuick

Roll over image to zoom in

Hot Air Rework or Oven Soldering

- Hot Plate method
- Sand method
- Takes some patience
  I'm told...

Stencils for the Paste

- PCBWay sells stainless steel stensils (made from the “paste” layer of Diptrace or others) for only $15.
- Same stencil used by all of your club members!
- This makes for very simple club projects
-